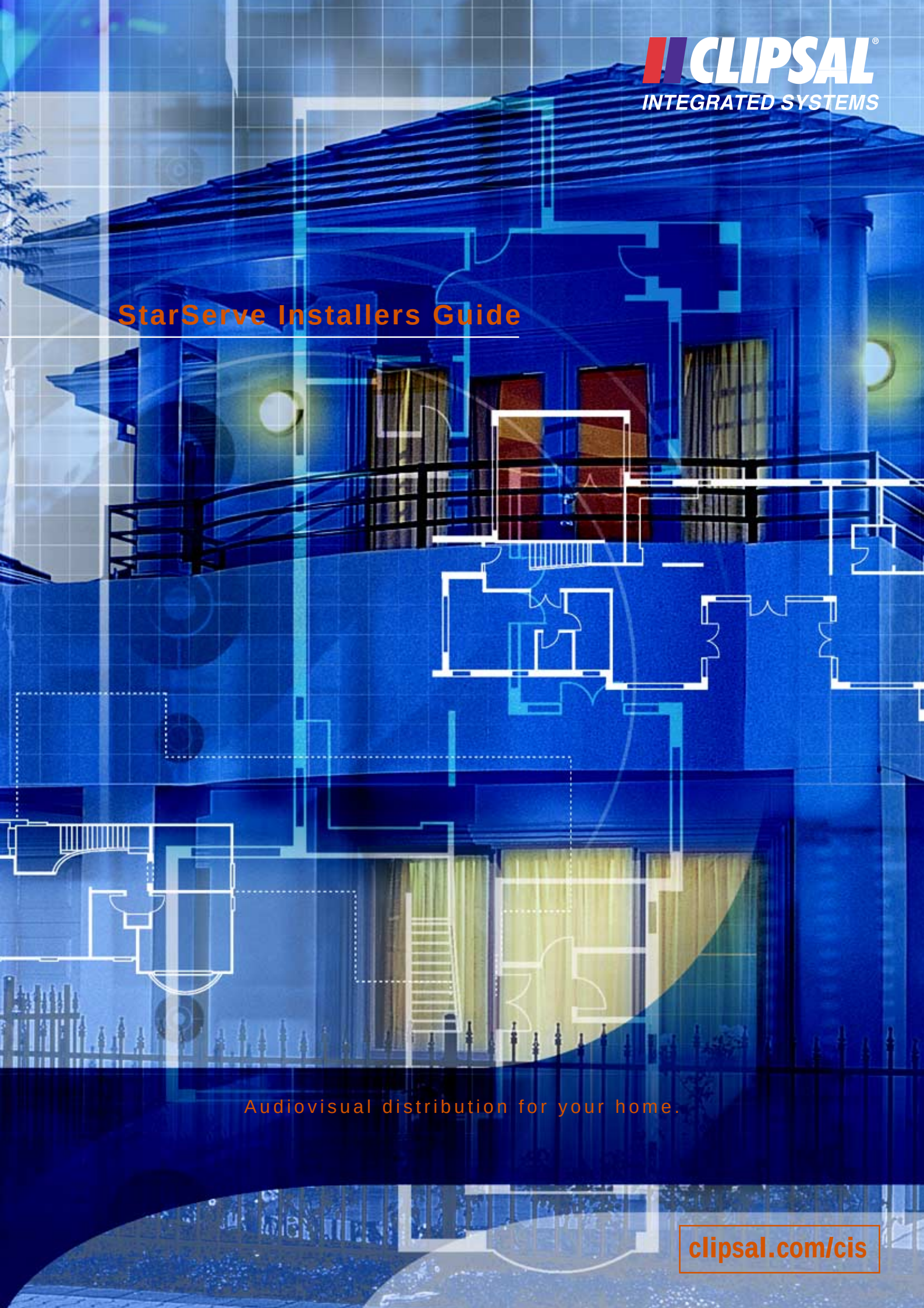
CLIPSAL
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StarServe Installers Guide
Audiovisual distribution for your home.
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Preface

The StarServe™ Installers Guide has been compiled to assist installers with the design and installation of the StarServe system components. This guide is not however, intended to be a complete guide to all aspects of structured cabling systems.

The information contained in this guide is advisory only. It is the responsibility of the installer to be aware of the standards and regulations that govern the installation practices and requirements for these types of products.

Information presented in this guide is either product specific or relates to aspects detailed in the following references.

- AS/NZS 3080: Telecommunications Installations - Integrated telecommunications cabling systems for commercial premises
- AS/NZS 3085: Telecommunications Installations - Administration of communications cabling systems
- AS 3815: A guide to coaxial cabling in single and multiple premises
- AS/NZS 3086: Telecommunications Installations - Integrated telecommunications cabling systems for small office/home office premises
- ACA TS 008: Requirement for Authorised Cabling Products
- ACA TS 009: Installation Requirements for Customer Cabling (Wiring Rules)
- AS 3000: Electrical Installations - Buildings, Structures and Premises (SAA Wiring Rules)
- ANSI/TIA/EIA-570-A: Residential Telecommunications Cabling Standard
- ANSI/TIA/EIA-568-A: Commercial Building Telecommunications Cabling Standard

Installers of StarServe products should be conversant with the above documents.

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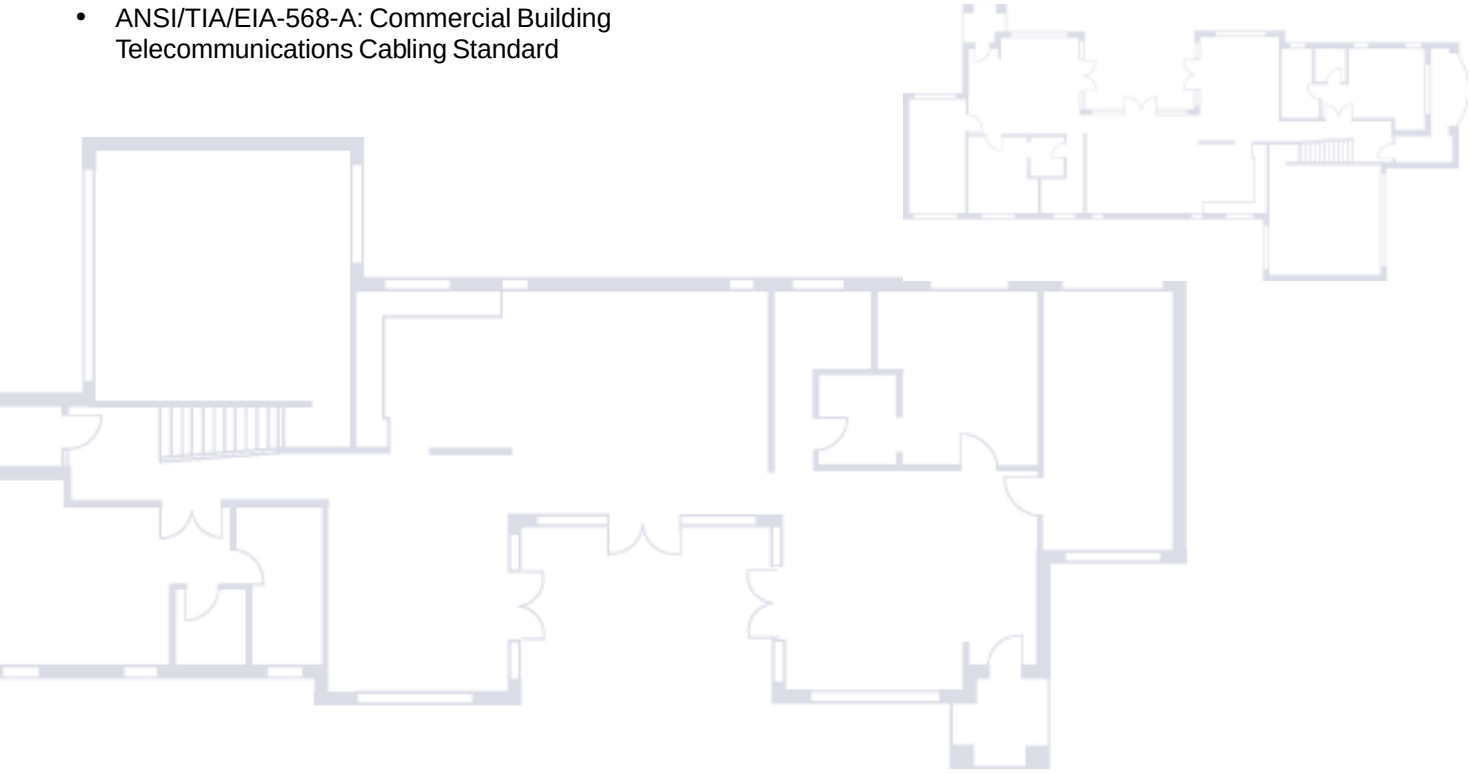


Structured cabling systems

Commercial Origins

Structured cabling systems have been installed in commercial buildings for many years. Their purpose is to distribute communication services via the cable infrastructure installed during construction.

Problems with RFI (Radio Frequency Interference), EMI (Electromagnetic Interference) and other forms of interference are minimised, as during construction strict cabling standards can be readily adhered to.

The objective of a structured cabling system is to provide an infrastructure that supports the ongoing service requirements of occupants within the building. Whilst an installation may cater for the initial requirements of the occupants, over time there will be the requirement to modify, add or change services within the building. If the building has a structured cabling system, it will support modifications, additions and changes with little or no need for recabling.

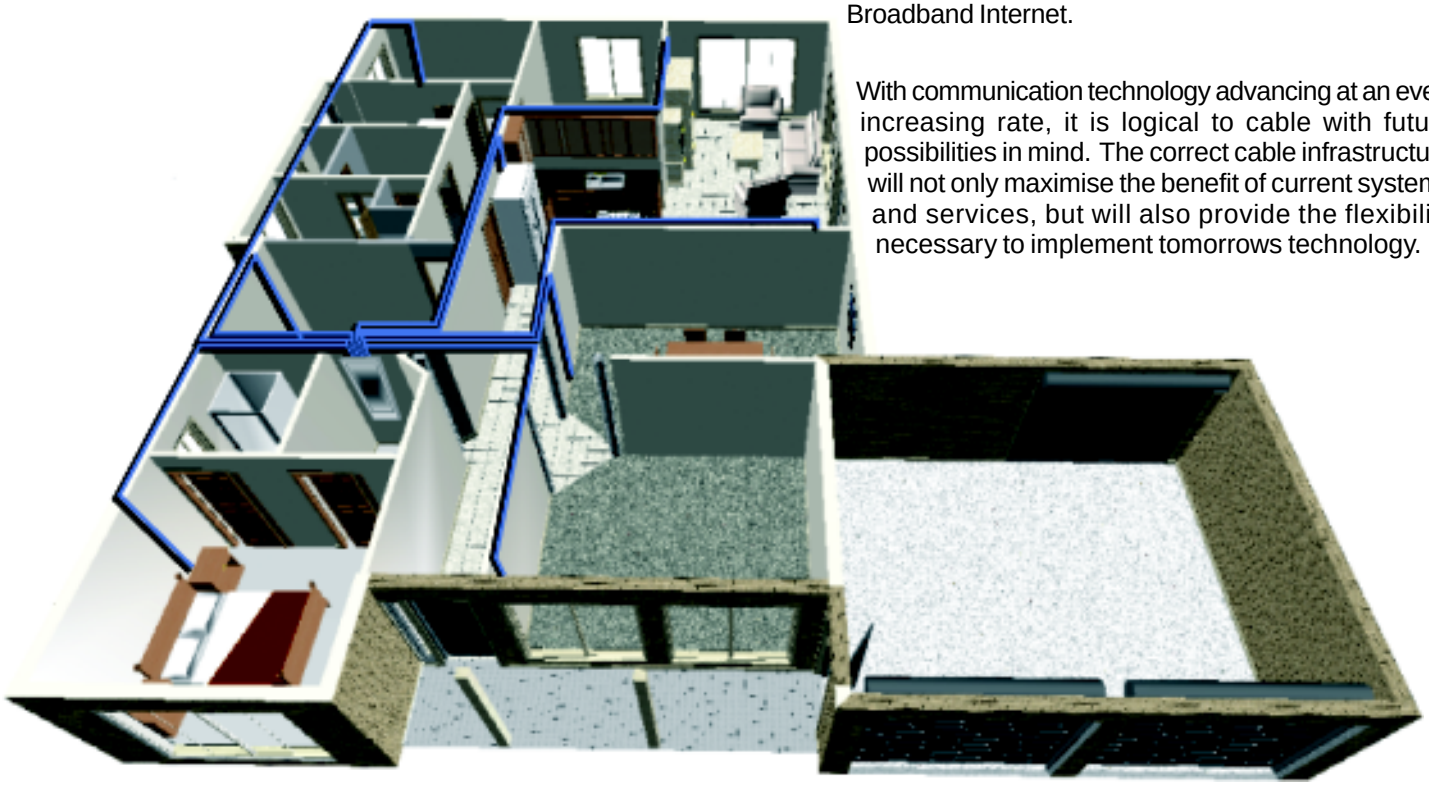
Residential Implementation

Homes today are implementing a broad number of services and systems that can rival those of commercial buildings. Therefore the introduction of structured cabling systems within the home is becoming a necessity.

In the past, homes typically had one or two telephones on a single incoming line, video was one antenna connection and a data network wasn't a consideration. Now however, homes may have numerous incoming telephone lines with multiple handsets, fax machines, answering machines and modems.

Video distribution is no longer a single antenna connection for receiving free to air television. It may also incorporate cable TV, Satellite, Video, DVD or CCD cameras. Data networks are a necessity for those wishing to utilise modern communication services such as, as PC Networking and Broadband Internet.

With communication technology advancing at an ever-increasing rate, it is logical to cable with future possibilities in mind. The correct cable infrastructure will not only maximise the benefit of current systems and services, but will also provide the flexibility necessary to implement tomorrows technology.



The structured wiring solution offered by Clipsal Integrated Systems is StarServe. The StarServe system is available in various basic configurations, all of which incorporate a grid assembly that allows each system to be expanded to meet the needs of the user.

The 'wiring topology' of a system is its physical layout and how it is connected. The topology in a structured wiring system is called 'Star Wired' or 'Home Run'. This is where all the cables start at a central location (i.e., the StarServe enclosure) and radiate outward in a star topology to each of the outlets within the home.

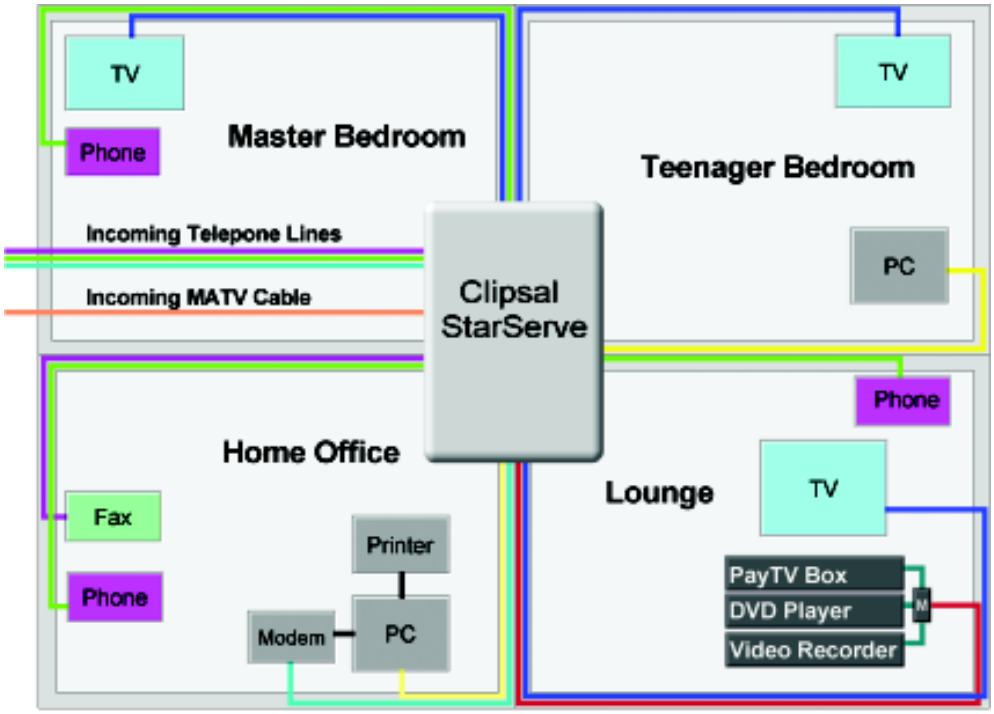
The Star Wired concept means that the cables are only terminated at the ends, and are never tapped mid-run. There is only one connection point after the cable exits the StarServe enclosure, at the wall plate. This eliminates many problems and also provides maximum flexibility.

Each wall plate outlet should have a minimum of one F-Type connection and one 8 pin modular connection (RJ45), cabled with one RG-6 quad shield cable and Category 5 cable respectively.

However, it is recommended to have at least two RG-6 and two Category 5 cables at each point, with three RG-6 and three Category 5 cables run to the main audio/video entertainment area.

The number of cables being installed should not be economised. There is little difference in the initial labour costs between running one or two cables to a single location. However, should additional cable be required at a later date, the cost will be significant.

It is important to note that a structured cabling system design should be independent of the initial equipment being installed.



"Structured cabling systems are all about infrastructure, not only for today's requirements but for tomorrow's."

StarServe™ Lite

StarServe Lite is an entry-level system for telephone and video reticulation.

It provides telephone distribution for four incoming exchange lines, with each being connected to up to six telephone points within the home. In addition, the unit has two, 8-pin RJ45 modular connectors. One connector expands the number of distribution points (utilising an additional wiring hub), whilst the other connector provides Mode 3 wiring configuration for security devices.

Broadband (or RF) video distribution is via a one in / six out Video Distribution Unit (VDU) that provides four outputs for short cable runs (up to 22 metres) and two for long runs (up to 45 metres).

The VDU is powered by a 12Vdc regulated plug pack.

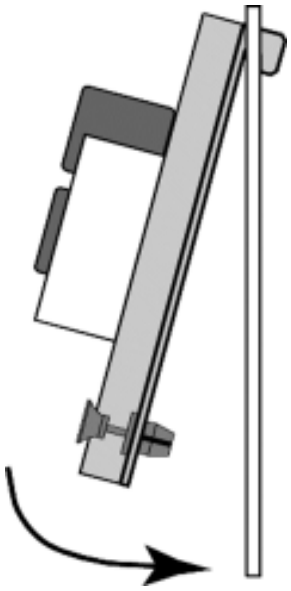
All coaxial cables are connected via F-Type connectors. 12 connectors are supplied with the system.

The telephone and video distribution modules hook on to the base grid plate, the cover then simply hangs from the plate.

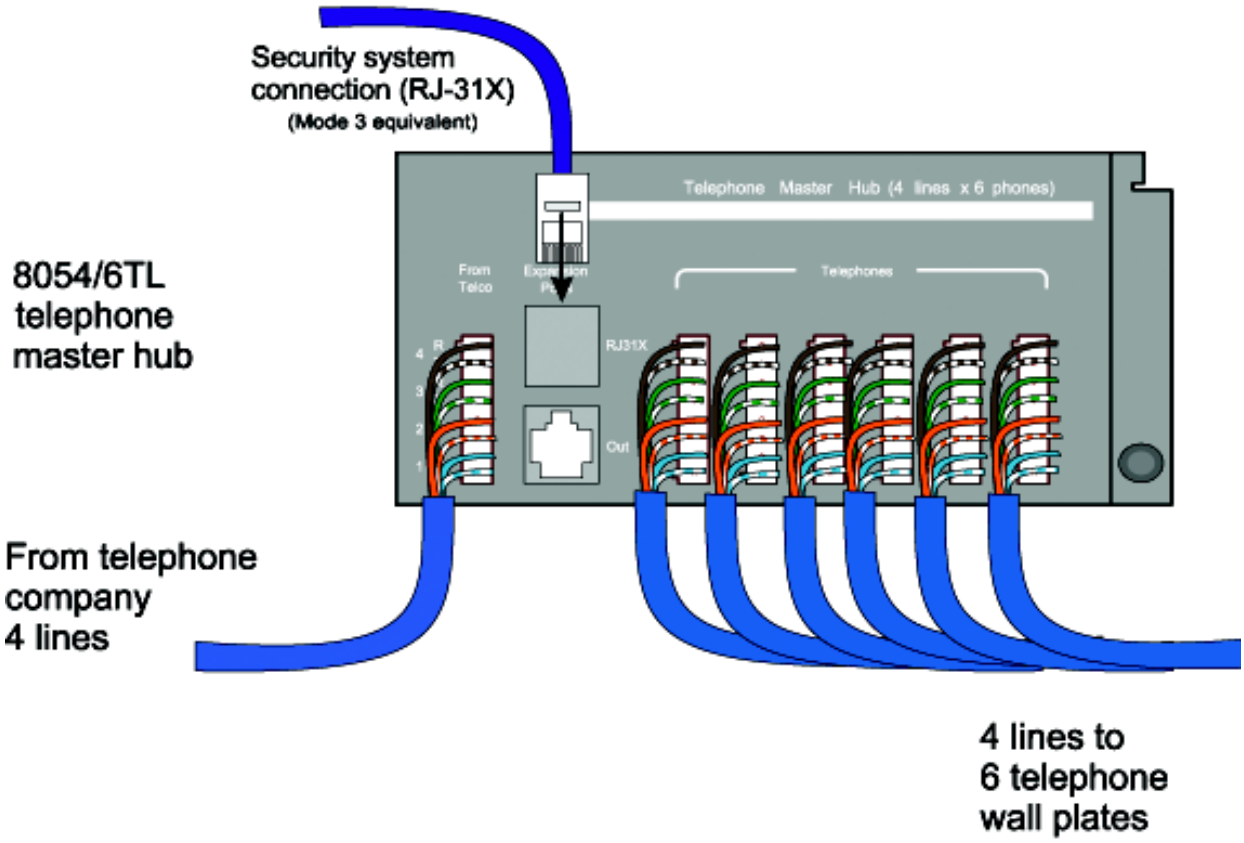
There is sufficient space for an additional StarServe module, such as a data hub, in a StarServe Lite enclosure.

Mounting StarServe™

Lite modules

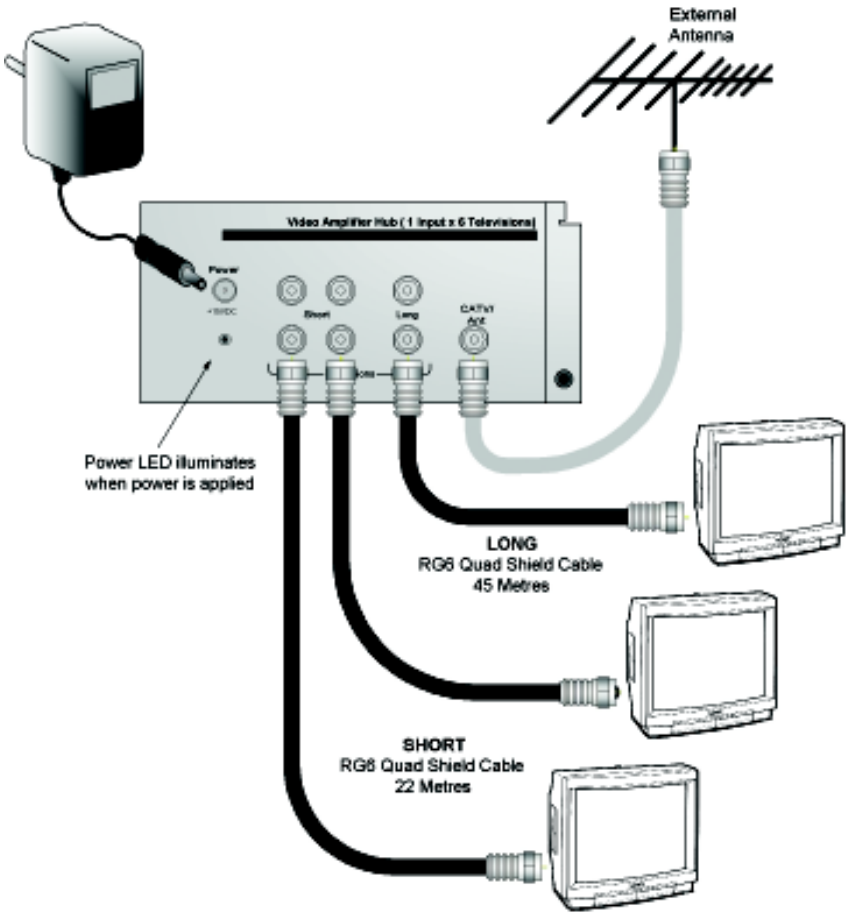


Telephone Connections



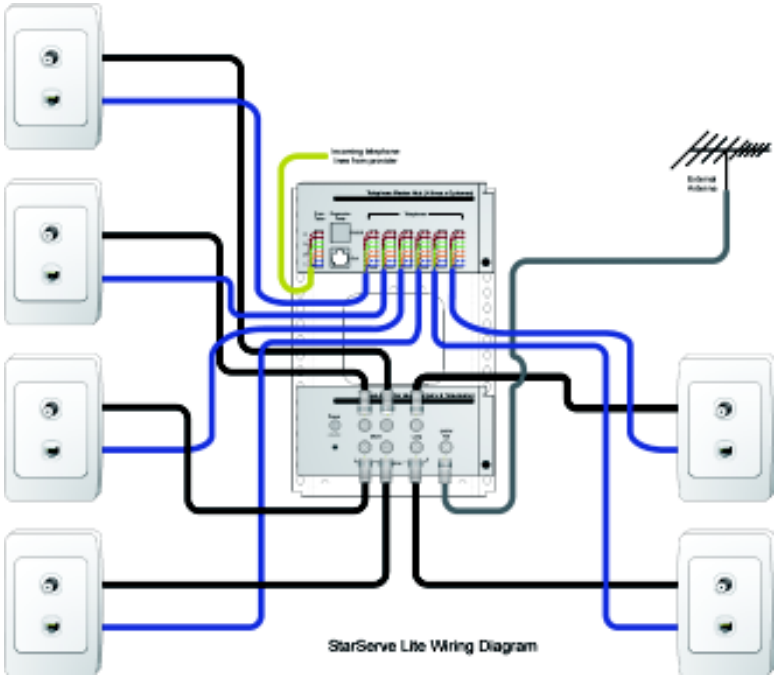
StarServe™ Lite

Video Connections



StarServe™ Lite

Video & Telephone Connectors



StarServe Video distributes Broadband (RF) video, and can distribute both local and broadcast (TV) video services to eight locations.

The system comprises of a three input / eight output Video Distribution Unit (VDU), mounting grid and cover, a 12Vdc regulated power pack and 12 F-Type connectors.

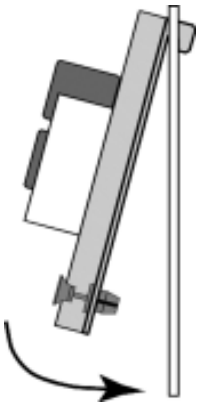
The VDU has a built in infra-red distribution engine, which, with additional components, allows the control of devices such as video recorders or DVD players from multiple locations within the home. The VDU allows the distribution of locally modulated video sources as well as commercial free to air television channels.

The VDU is powered by a 12Vdc regulated plug pack.

Each of the eight outputs can be cabled up to 45 metres from the VDU. Inputs, such as those from modulated sources, can be run up to distances of 22 metres.

All inputs and outputs are connected to the VDU via F-Type connectors. 12 F-Type connectors are supplied with the system.

The StarServe Video system is supplied with the same housing and grid mounting as the StarServe Lite.



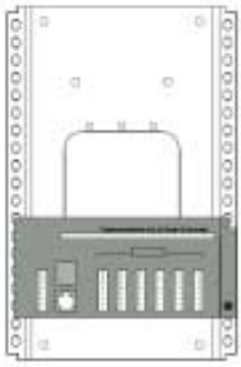
Modules hook on to the base grid plate of the housing.

As StarServe video is provided with one module, there is room for two additional StarServe modules, such as a data hub or an additional VDU.

Video StarServe™

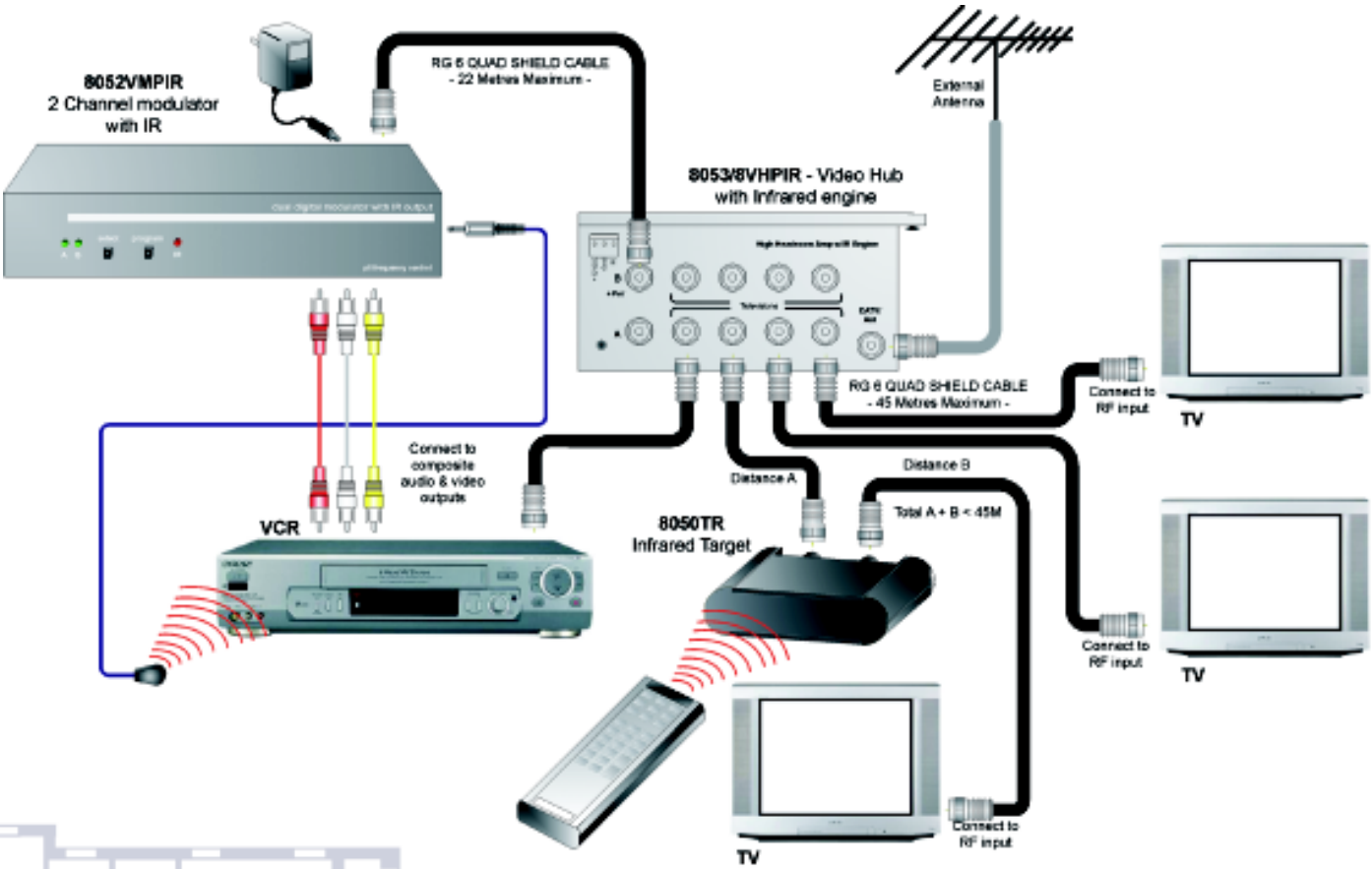
Mounting Modules

1) Hook from the top
2) Swing into place
3) Push button to lock



StarServe™ Video

Video Connections



StarServe Pro has a greater capacity for expansion than the Lite or Video systems. Telephone, data and video distribution is combined, with the capacity to add C-Bus DIN rail mounted devices, such as a C-Bus Network Interface device.

StarServe Pro is supplied with a cabinet that can be surface or flush mounted, similar to an electrical distribution board.

The system distributes data and telephone services via 8-pin RJ45 modular sockets, in a 'soft-patch' configuration, where the user can change a wall socket's function by 're-patching'.

These soft-patch changes take place at the StarServe Pro enclosure. To change a telephone outlet to a computer data outlet, the user would unplug the patch lead from the telephone harmonica and simply plug it into the data hub (optional), assuming the telephone handset has been disconnected from the wall socket.

To enable this flexibility, all telephone and data outlets need to be terminated in the same way (Refer to the Voice & Data Section).

Every modular socket on each of the wall plates can be patched as either a data socket or a telephone socket, or used for other applications suitable for twisted pair cable.

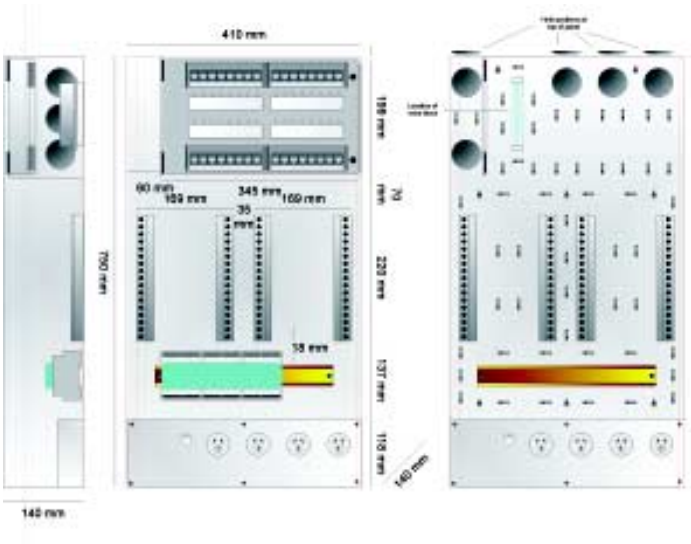
All outlets are Star Wired back to the StarServe Pro enclosure and terminated individually on to the 8-pin RJ45 modular sockets. The sockets are in panels of eight outlets, known as harmonicas.

There are two types of harmonicas supplied with the StarServe Pro.

- Eight Way Harmonica, which provides eight individual RJ45 sockets.
- Eight Way Harmonica, which provides two banks of four RJ45 Sockets (common connections).

The StarServe Pro has provision for two additional harmonicas of each type.

The StarServe Pro system incorporates the same VDU as the StarServe Video system and has space for an additional VDU. As the VDU incorporates an infra-red engine, all the StarServe infra-red accessories can also be used with the StarServe Pro system.



Within the StarServe Pro cabinet, a 16 module wide DIN rail is provided for use with Clipsal C-Bus DIN units such as a C-Bus PCI (Personal Computer Interface), a CNI (C-Bus Network Interface) or future C-Bus devices.

The additional grid allows up to two, five port switched hubs to be mounted in the StarServe enclosure.

There are four, 240V power sockets available within the cabinet for connecting power packs.

Additional StarServe™ Components

Each of the StarServe systems can be expanded based on:-

- The cabling infrastructure. If enough cable was not installed initially, it will probably be cost prohibitive to expand the system with additional StarServe products.

- The StarServe products currently installed and the expandability of those products. For example, the Video Distribution Unit supplied with the Lite system does not incorporate an infra-red engine and hence infra-red components will not function if added.

Connectors and Grid Plates

All grid plates or connectors can be sourced from the Clipsal Electrical Accessories range.

Infra-red Options

The Video Distribution Unit supplied with both the StarServe Video and StarServe Pro system is the 8053/8VHPIR. This VDU incorporates an Infra-red distribution engine. The infra-red engine comprises of circuitry that facilitates the transmission of infra-red signals.

Normally, infra-red control works based on line of sight, therefore the remote control requires an unobscured view of the equipment to be controlled. However, the infra-red engine in the StarServe VDU allows audio/video equipment to be controlled from many locations in the home, as if in the same room.

Infra-red signals received from a hand held infra-red remote at multiple locations could be routed to a single location where infra-red transmitting hardware rebroadcasts the signal to a control device such as a VCR or DVD.

Infra-red Targets

Infra-red targets connect in line on the coaxial cable between the wall plate and the television. They receive infra-red signals from remote controls and pass them back to the Video Distribution Unit along the same coaxial cable that supplies the video signal.

The targets are powered by the VDU and, if any of the eight outputs on the VDU senses that no target is present, it will switch off the power supply to the individual outputs. The infra-red target incorporates a dc block. Hence, the voltage will not be passed through to the Television.

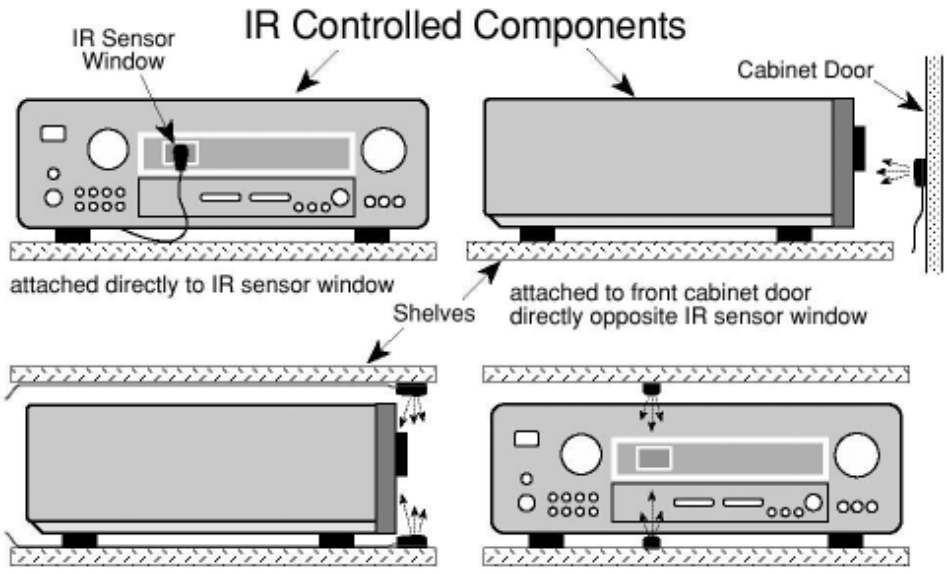
If the infra-red targets are added at a later date, or the infra-red system is not functioning, powering down the VDU for approximately 30 seconds will reset all outputs, making the voltage supply available upon power up.

Infra-red Emitters

The electrical connection on the Infra-red Emitter Lead connects to an emitter output on either a StarServe modulator or an emitter wall plate. There is a single head IR emitter lead and a double head IR emitter lead available in the range, each 1.5 metres in length.

The IR emitters are located on or near the equipment to be controlled (i.e. a VCR).

When a target in a separate room picks up a signal, the signal is relayed via the infra-red engine in the VDU and rebroadcast by the emitter.

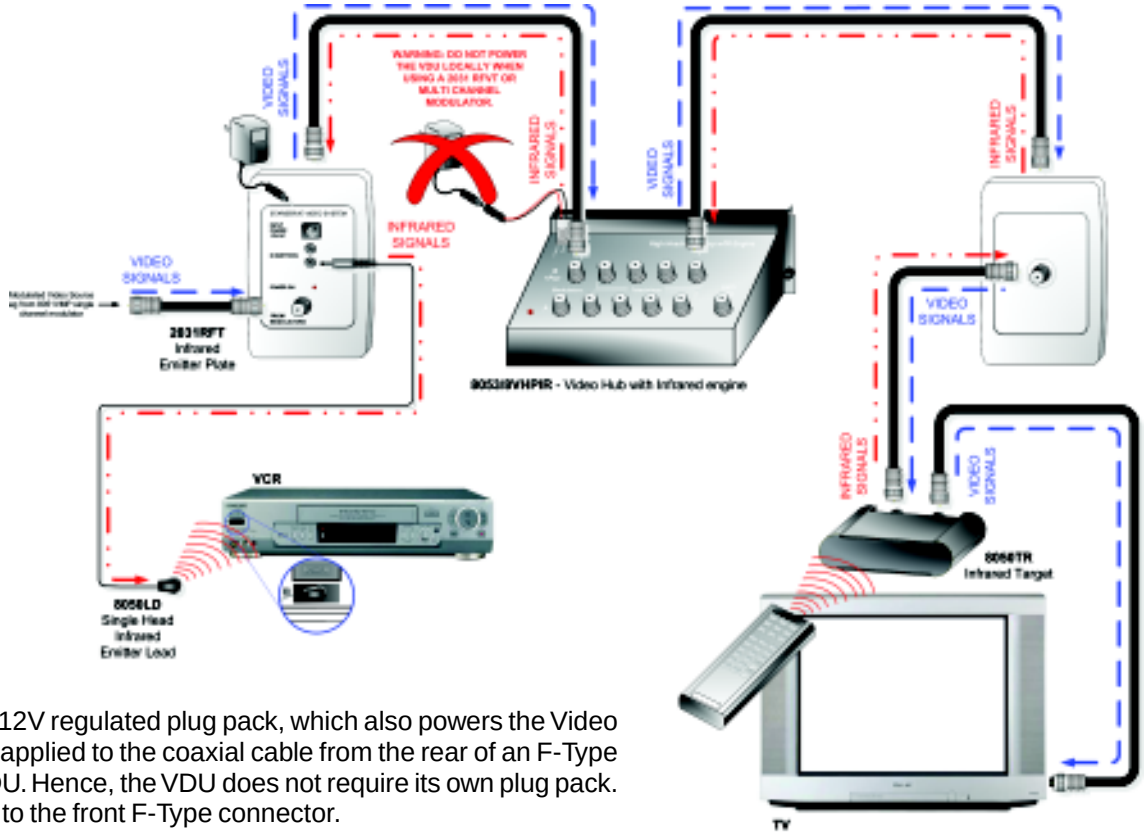

IR Controlled Components
IR Sensor Window
Cabinet Door
attached directly to IR sensor window
Shelves
attached to front cabinet door directly opposite IR sensor window

The emitter diagram above is only an indication of possible emitter locations and locations should be tested before the emitter is secured.

Infra-red Output Plate, 2031RFT

The Infra-red Output Plate has two emitter sockets, a power input, and a passthrough F-Type coaxial connecter (one connection on the front and one on the rear).

Infra-red Diagram



The plate is powered by a 12V regulated plug pack, which also powers the Video Distribution Unit. Power is applied to the coaxial cable from the rear of an F-Type connector to power the VDU. Hence, the VDU does not require its own plug pack. No power passes through to the front F-Type connector.

Modulators

Modulators take a Baseband (Composite) video signal and audio signal and modulate it onto a Broadband channel. The channel is user selectable and, once connected to a Video Distribution Unit, allows that channel to be viewed on any television connected to a VDU output.

There are three Modulators in the StarServe range:-

Single channel modulator 8051VMP

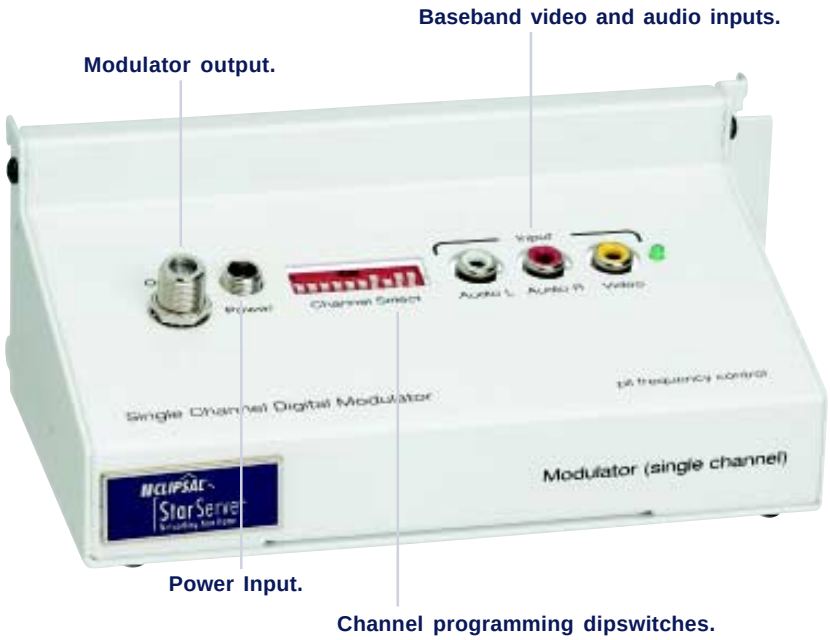
Two channel modulator 8052VMPIR

Four channel modulator 8054VMPIR

Each Modulator is supplied with a 12Vdc regulated plug pack.

Single Channel Modulator 8051VMP

The single channel modulator is configured via a series of dipswitches, and provides channel selection from UHF 28 - 67.



Two & Four Channel Modulators 8052VMPIR / 8054VMPIR

The two and four channel Modulators are internally combined and provide a single coaxial output. They also provide infra-red outputs for the connection of emitters. The two channel modulator provides two emitter connections and the four channel version provides four.

Each of the modulator video inputs can be assigned a Channel via the buttons on the front panel. Channel selection is from 28 - 67 in the UHF band. Four different models are available to suit different international broadcast standards.

The two and four channel Modulators also provide power to the Video Distribution Unit, this means the VDU does not require power locally.

Example - To program Input A as channel 42:-

1. Press the SELECT button until the LED of input A is ON
2. Press the PROGRAM button for the tens value of the channel to be programmed, in this case four times.
3. The LED will extinguish.
4. Pause until the LED comes back ON.
5. Press the PROGRAM button for the ones value of the channel to be programmed, in this case two times.
6. The LEDs of the other inputs will give a rapid flash to indicate the channel has been accepted.

To read back a programmed channel, select the channel to read, press and hold the program button for 5 seconds then release. The programmed channel will flash back.

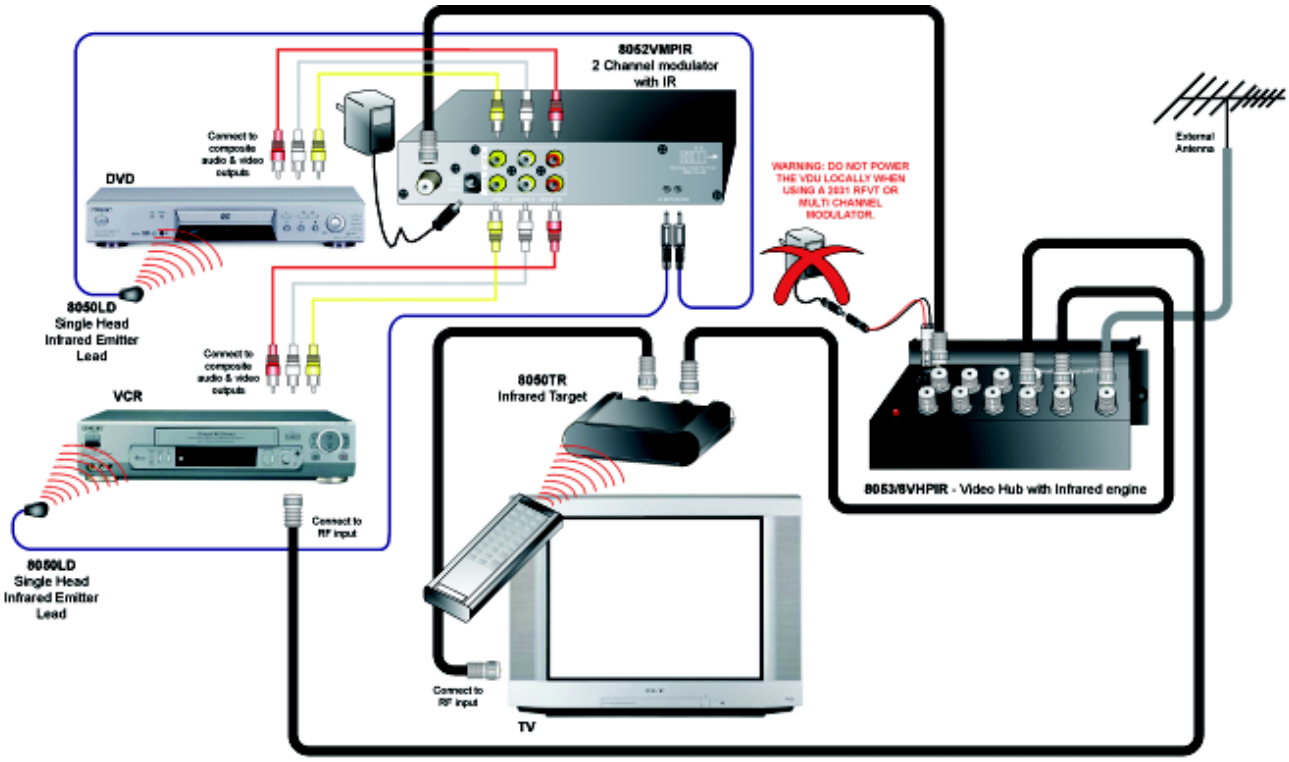
If an incorrect channel selection is made, the input LED flashes repeatedly for about a second.

If a channel is programmed that is plus or minus one or equal to a channel already in use, the LEDs of the conflicting channels will flash simultaneously at a slow rate.

If this happens, follow the programming procedure again, making sure to choose an appropriate channel. It is recommended the channels used be documented.

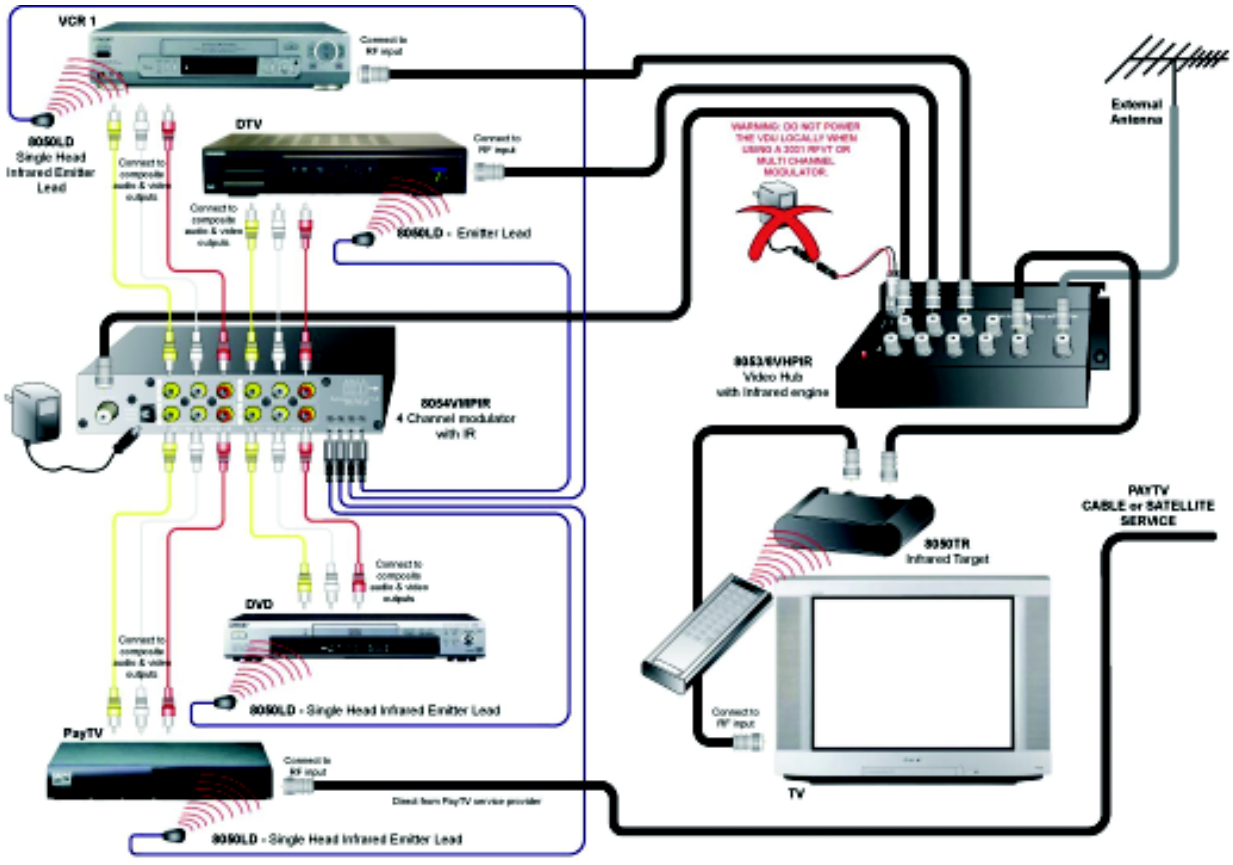
Typical Modular Connections

Two Channel Modulator connecting to a DVD and a VCR



Typical Modular Connections

Four Channel Modulator connecting to a VCR, DTV, DVD, and Pay TV



Modulator Combiner

The StarServe Modulator Combiner is an eight-input, one-output device and is designed to combine multiple modulated sources on to a single output. This output can then be connected to an input on the Video Distribution Unit. It is designed primarily to combine single channel Modulators, and will not pass a dc current or infra-red signals.

Single Output

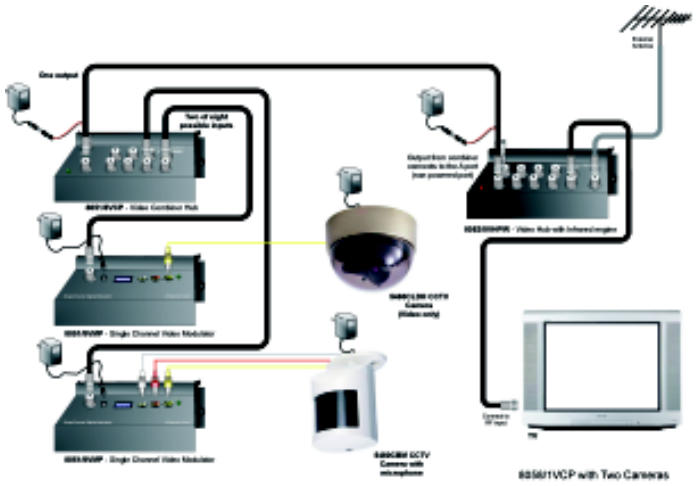
8 Inputs from modulated sources

The combiner provides a small amount of gain to offset any losses in the unit.

This unit is powered by a 12Vdc regulated plug pack. It does not supply any power to the VDU.

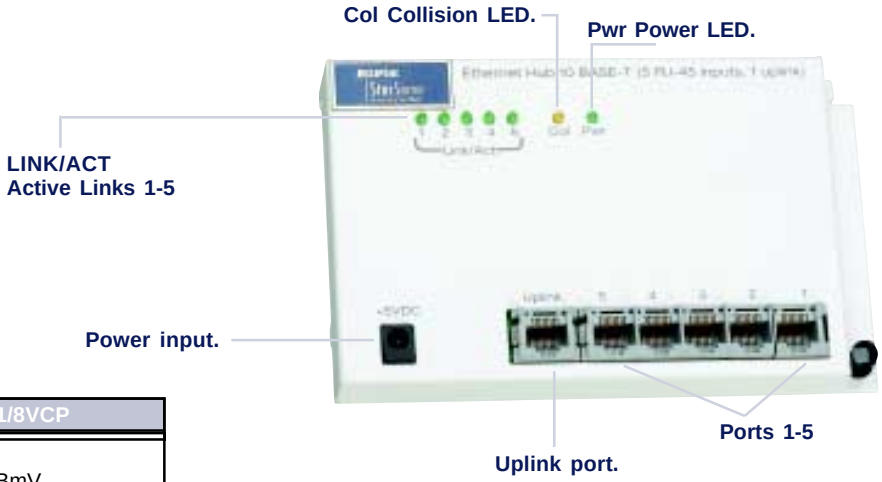
	Catalogue No.	8051/8VCP
RF Input	Number of Modulator Inputs	8
	Nominal Modulator Input Level	20dBmV
	Maximum Number of Modulated Channels	16
	Connector Type	8 x F-Type
RF Output	Number of Outputs	1
Connector Type	1 x F-Type	
Output Gain	Modulator Input to Output	~1dB
Bandwidth	Forward	400-860MHz
	Reverse	N/A
Power Supply	Model Number	8050P12/500
(Not supplied with	Output Current	500mA (300mA min)
E-Series variant)	Output Voltage	12VDC Regulated
Input Power	240VAC / 50Hz	
Mechanical Details	Dimensions	160 x 90 x 60mm (L x W x D)
	Shipping Weight (approx)	1.25kg
	Operating Temperature	0 – 50°C
	Operating Humidity	10 – 95% RH

Typical connection diagram for Modulator Combiner



Ethernet Hub 10-BaseT

The StarServe Ethernet Hub provides connection for up to five computer network devices. Port 5 on the unit is unused if the uplink port is used to connect to another hub. Each port has a corresponding LED indicating a device is connected and operating correctly. The power LED indicates power is available and the collision LED indicates a network collision has occurred.



	Catalogue No.	8055HUB10
Compliance	IEEE 802.3	10Base-T
Network Interface	Output Ports	5 x RJ45 Ports
Uplink Port	1 x RJ45 Port	
Maximum Cable Length	CAT5 UTP	100 metres (328 feet)
LED Indicators	Each Unit	PWR, COL
	Each Port	LINK/ACT
Power Supply	Model Number	8050P5/800
(Not supplied with	Output Current	800mA (800mA minimum)
E-Series variant)	Output Voltage	5VDC REGULATED (±5%)
	Input Power	240VAC / 50Hz
Mechanical Details	Dimensions	160 x 100 x 31mm (LxWxD)
	Shipping Weight	1kg
	Operating Temperature	0 – 50°C
	Operating Humidity	10 – 95% RH

StarServe Installation Requirements

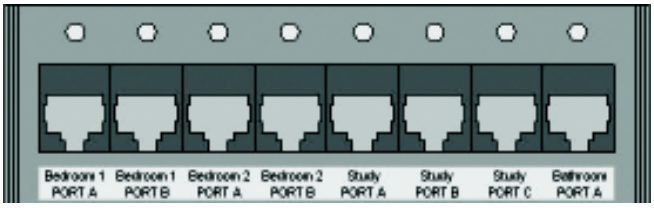
The StarServe system allows distribution of telephone, data and video services. The installation requirements can be broken down into these three elements.

Recommendations made in this guide are based on Australian, New Zealand and US cabling standards. Installation of the StarServe product should be performed by a licensed or appropriately certified installer according to the rules, regulations and standards determined by the relevant governing bodies.

Labeling & identification

When cabling a StarServe system, it is important that both ends of each cable are clearly marked. When fitted off, each termination point on a wall plate should be labeled for identification.

Labeling wall plates, patch panels and termination devices (e.g. 110 punch down block) is an essential part of a structured cabling system. With a number of Category 5 and coaxial cables running to a single location, it is necessary to be able to differentiate between cables. This is essential when it comes to changing the use of cables, e.g., changing from a telephone point to a data point.



There are a number of labeling methods which can be utilised with a StarServe system. Each of the possible labeling methods vary in suitability for a given installation. Therefore, the installer should choose a method, which meets the needs of both the installation and the user.

Colour

Use of colour can help in the identification process, particularly for the user.

Different colour coaxial cables can be used to differentiate between upstream (modulated sources) and downstream (distributed video, including free to air TV) services.

Different coloured 8P8C sockets can also be used to assist identification on a single wall plate.

Labeling systems should be flexible and should not be implemented such that a socket is precluded from use as either a telephone point or a data point.

Plate Identification

The Clipsal DataComms Label Printing Software Package is designed for the Clipsal C2000 Classic Series wall plates and 30PID labels. This software is distributed free of charge as part of the Clipsal Alfred Trade Product Guide on CD-ROM. It enables installers to quickly and easily print their own labels. The CD contains an extensive tutorial, which fully explains how to print labels.

30PID

The Clipsal 30PID is an identification plug that fits in place of a connector and provides a clear window for viewing a label. The window allows a label approximately 12mm x 12mm in size.

C2000 Labeling System

The Clipsal Classic Series of plates incorporate a window ID system similar to the plug in 30PID, except the clear windows sit to the side of each socket and require a pre-punched cover plate. This window allows a label approximately 14mm x 6mm in size.

Surround IDS

Within the Clipsal 2000 series, there are surround IDs that allow identification of a plate via a plug in ID number. Whilst it does not identify single connections, i.e. individual sockets or F-Type connectors, it can be useful to differentiate between multiple plates within a single room.

Label Makers

Either used alone or in tandem with the ID systems, label makers provide a simple and easy way of labeling each point in the system. The labels are produced on a specialised tape with a professional result.

Enclosure Identification

The StarServe Lite and Video systems require cable labeling to be clear and distinct, whilst the StarServe Pro allows labeling of each 8P8C socket, and therefore less requirement for labeling on Category 5 cables.

The RG-6 cable in StarServe systems always require labeling, as they may not necessarily be terminated on dedicated ports. The labeling of each RG-6 cable within all StarServe systems is achieved with a dedicated label maker, as these labels will adhere to the cable. Using a label and clear heat shrink over the cable is a good alternative.

Installation Tools

Coaxial Cable Stripper

This rotary type stripper allows the cutter depth to be fixed for the size of cable being stripped.

F-Type Crimp Tool

Ensure that the jaws of the crimp tool cater for the specific size F-Type crimp to be used.

Modular Crimp Tool

A modular crimp tool can be used for making or repairing patch leads. Clipsal part no.

Cable Cutters

Rounded blade cutters do not deform the cable.

Clipsal Punch Down Tool

This is required for terminating Category 5 cables on wall sockets and patch panels. The Clipsal 3100RJA5V is a universal type punch down tool that is compatible with different IDC connections.

Telephone/Data Cabling Requirements

Only cabling for services required today will result in an inflexible system for tomorrow. Cabling for a range of future possibilities will provide the flexibility to be able to change the services without the need to recable later.

All telephone and data cabling should be Category 5 or higher, with Category 5e recommended.

Cable categories refer to the bandwidth available on the cable, the higher the category the greater the bandwidth.

** Category 1- voice * Category 2- up to 1 MHz * Category 3- up to 16 MHz * Category 4- up to 20 MHz *Category 5- up to 100 MHz * Category 5e- up to 100 MHz*

The category rating of the cable used is dependent on correct installation practices.

When cabling with Category 5 cable, always adhere to the appropriate standards and regulations.

Cable Support

Category 5 performance will only be achieved with adequate cable support.

- Cables (regardless of type) must be supported i.e. they must not sag or stretch under their own weight.
- Cables should not be pulled across suspended ceiling tiles or across fluorescent luminaires.
- Cable should not be tied to ceiling grid work wires.
- Where necessary, use approved cable trays, conduit or Category 5 “J Hooks”.

Cable Pulling

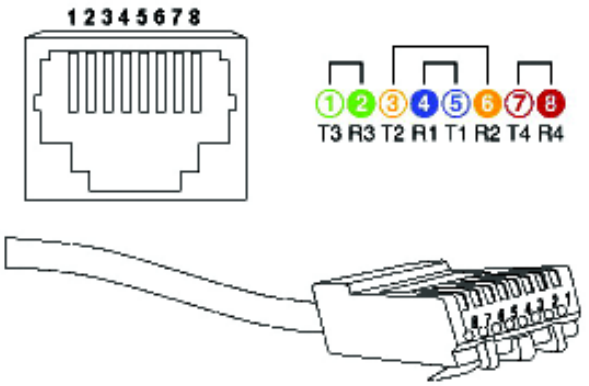
- Avoid tight bends, sharp edges, sharp corners, kinks and turns.
- Make pulls as straight as possible.
- Do not drag cable around corners.
- Gradually pull cable into place.
- Pulling tension should not exceed the recommendation of the manufacturer or 11kgs, which ever is lesser.
- Care should be taken to minimise cable twisting.
- Avoid unnecessary bends. During installation, keep the bend radius as large as possible.
- The minimum bend radius is ten times the outside diameter of the cable during installation.

Cable Runs

- Avoid high temperature areas as high temperatures increase cable attenuation.
- Replace damaged cable.
- Apply cable ties loosely.
- Avoid sources of EMI.
- Run cable at least 150mm away from fluorescent luminaires.
- Never exceed 90° bends.
- Never over tighten cable ties.
- Never step on or run over cable.
- Never splice or use bridge taps.
- Never use staple guns.
- Never overstress the cable.
- The maximum horizontal run should be 90 metres from termination point to wall socket.

Terminations

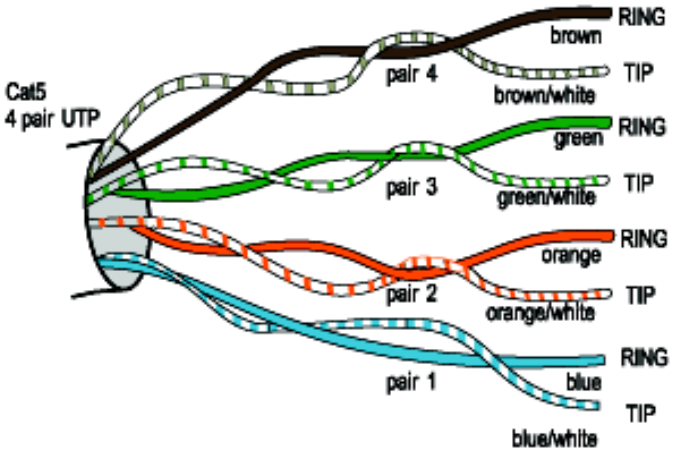
Category 5 cable runs and terminations on a modular RJ45 socket should be carried out in accordance with the relevant communications and data standards. Each socket can be used for either a data or telephone application. If the installation and termination of data and telephone points are different, the flexibility of the system will be diminished. All Category 5 terminations should be carried out to T568A Standards.



Other Telephone / Data Cabling Requirements

- Cables from a wall outlet to a network interface (e.g., computer or printer) should be a maximum of 3 metres.
- A minimum of two outlets at each location.
- The recommended jumper/patch cord length is 7 metres.
- A maximum of 2 patch cords per horizontal run.
- To reduce untwisting of cable pairs, strip back only as much cable jacket as required.
- The untwisting of a pair should not be greater than 13mm for Category 5 cable.
- Maintain proper bend radii.
- Allow additional cable at each end for re-termination.
- Any additional cable should have a fixed path, i.e. if a cable loop is left, ensure it is secured.

Wire Colour Codes



Testing

All Category 5 cables should be checked for continuity and for correct pair termination.

The Clipsal 5ABLTC tester provides instant identification of the most common voice and data cabling problems including short circuits, open circuits, reversals, and incorrect polarity.

Further testing with specialised equipment will be required to verify the installation meets a specific category rating.

Mode 3/5 Wiring

Mode 3 and Mode 5 are specific wiring configurations for various telephone devices such as security systems and modems. This configuration allows the telephone device to gain priority of the line by disconnecting every device wired after the mode connection.The Mode 3 configuration disconnects both wires of the telephone line, Mode 5 will only disconnect one.

REN - Ring Equivalence Number

The REN relates to a specific device impedance on the telephone line. The maximum number of telephones or other customer equipment, connected to a single exchange line at one time is based on the total REN of all devices.

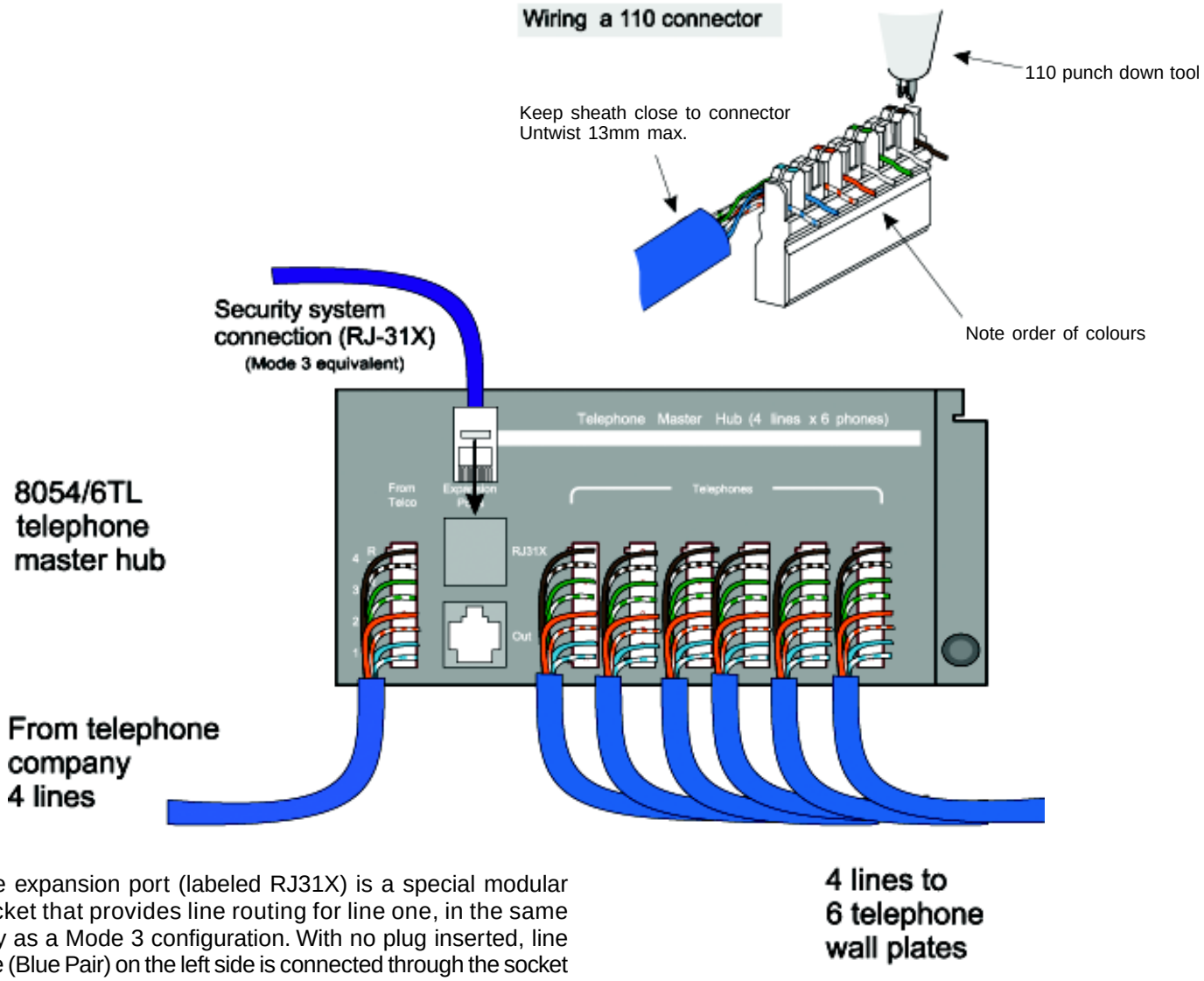
If there are too many devices connected to the line, it is possible that no telephone will ring. According to the ACA TS003. The Carrier is only required to support an REN of three. (All Austel approved telephone equipment since 1990 identifies its REN).This would mean that the line can support three telephones with a REN of 1 each.

Licensing

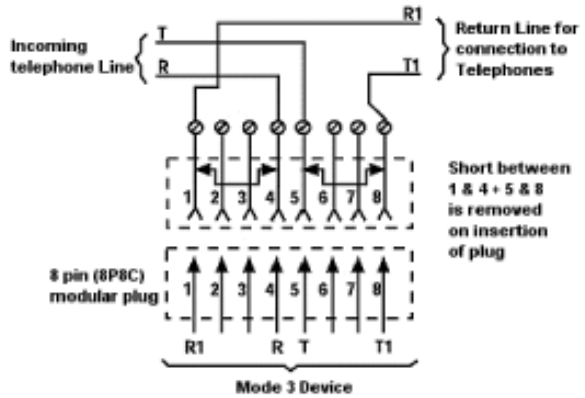
All cabling with the possibility of being connected either directly or indirectly to the PSTN (Public Switched Telephone Network) is required to be installed according to the appropriate standards by a licensed cabler.

Telephone Hub 8054/6TL

The Telephone Hub for the StarServe Lite allows each of the four incoming lines to be distributed to six points. These lines are terminated on a punch down block using a 110-termination tool.



The expansion port (labeled RJ31X) is a special modular socket that provides line routing for line one, in the same way as a Mode 3 configuration. With no plug inserted, line one (Blue Pair) on the left side is connected through the socket to each of the six line one connections on the right side. When an eight pin modular connector is inserted in the socket, this connection is broken locally and needs to be reconnected via a Mode 3 device such as a security system.

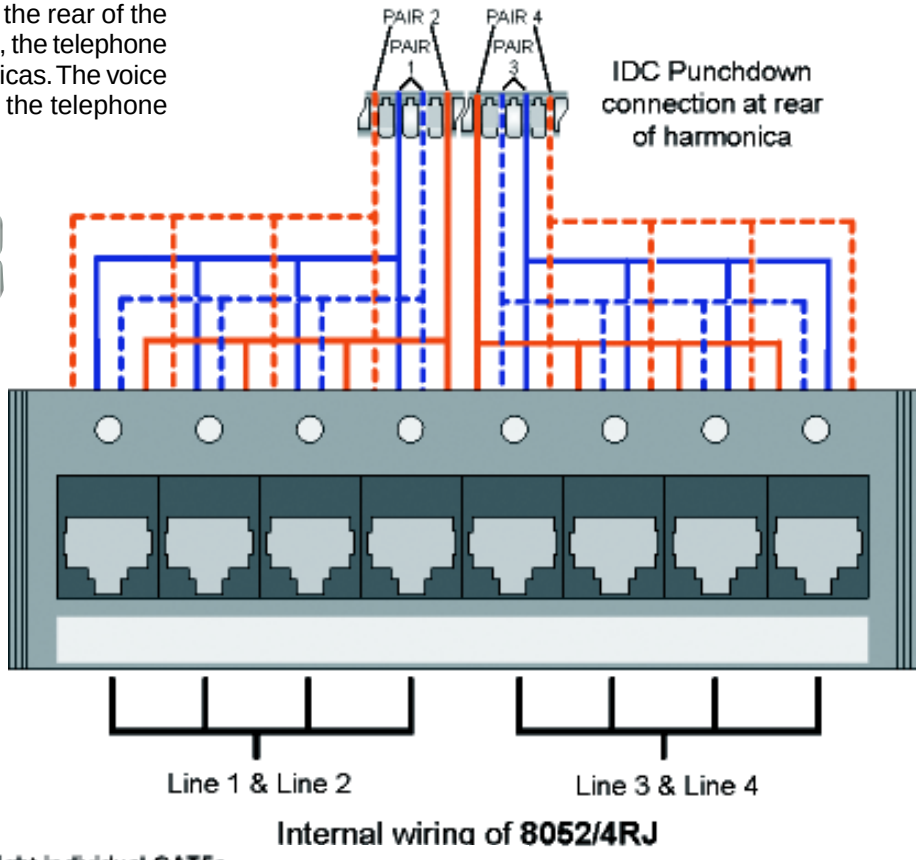


Telephone & Data Harmonicas

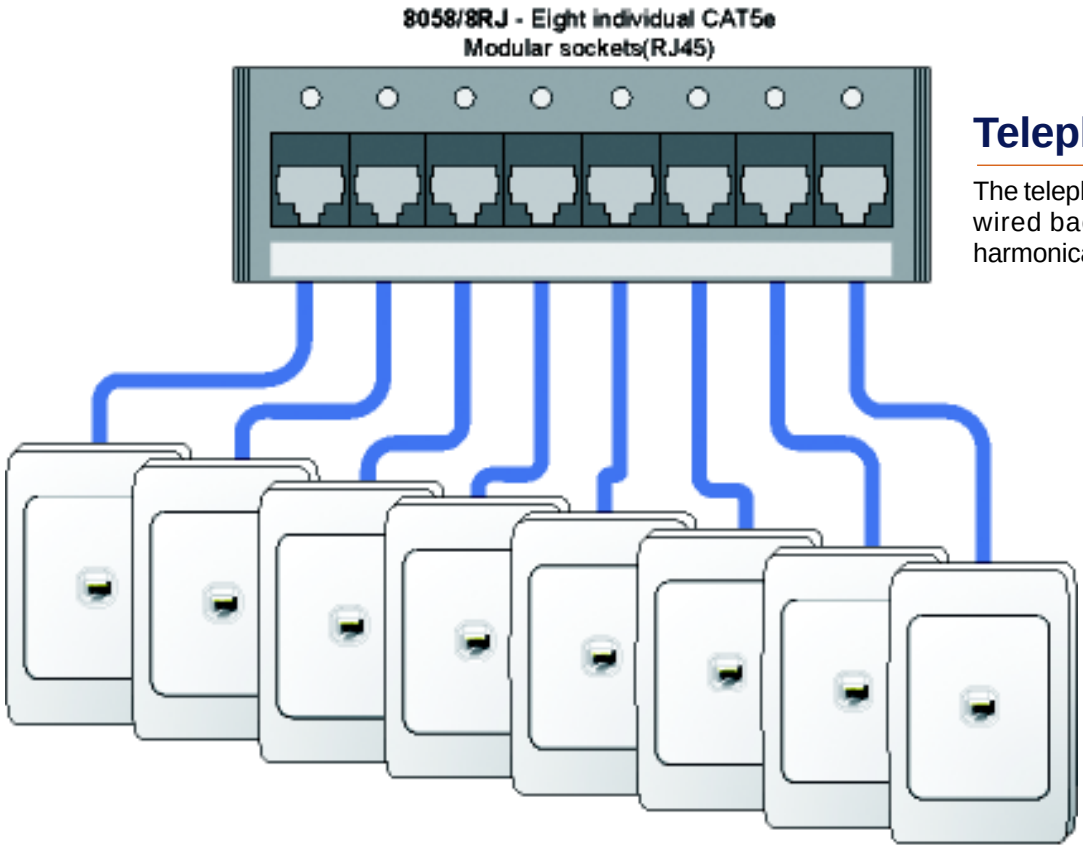
Incoming Telephone Lines

Incoming telephone lines are terminated on a voice block located behind the hinged panel and fixed to the rear of the StarServe Pro enclosure. From the voice block, the telephone lines are terminated on the telephone harmonicas. The voice block serves as a disconnect / test point and the telephone harmonica serves as the distribution device.

The telephone harmonicas have internal wiring, which link the sockets in two groups of four. The connections are common across the four sockets. Each of these banks can accommodate two pairs (two telephone lines). This allows the two lines to be connected to four outlets within a home.



Internal wiring of **8052/4RJ**



Telephone / Data Outlets

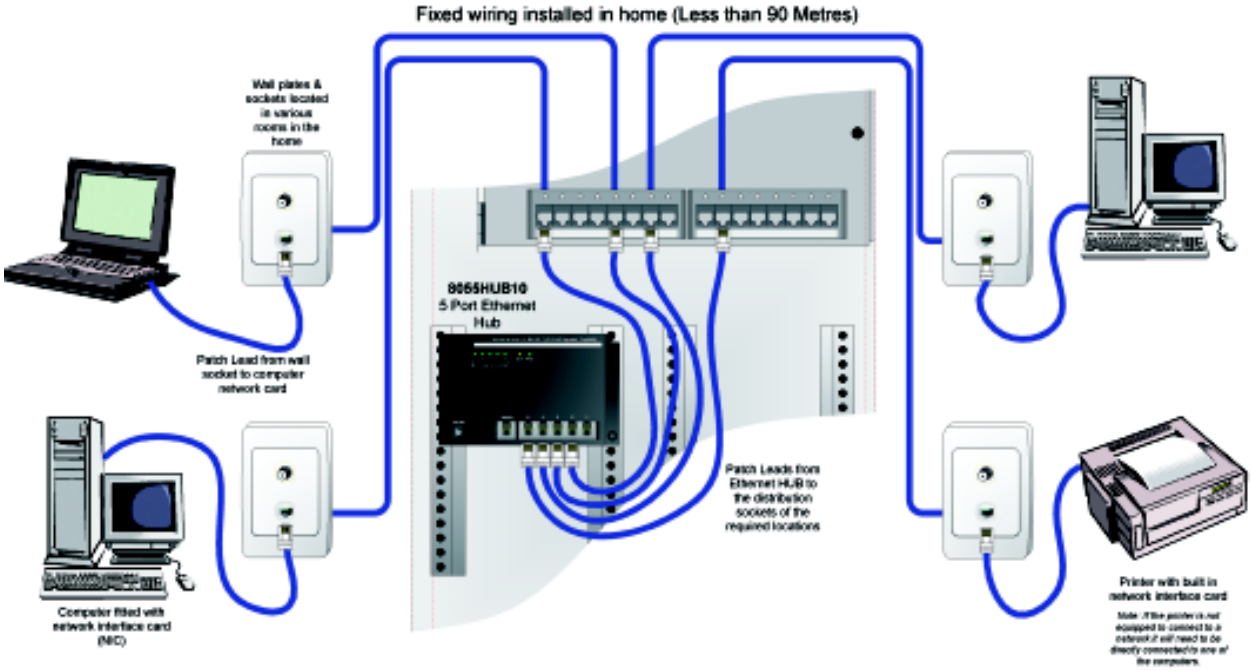
The telephone / data outlets are individually wired back to sockets on the eight-way harmonicas.

Each of the eight individual CAT5e sockets are cabled separate locations within the home

Data Connections

The Ethernet Hub attaches to the grid within the StarServe enclosure. Each port on the Hub can be connected to a network device (e.g., a network card in a computer) by using the patch cords to patch to one of the sockets on an eight way harmonica.

Additional devices such as an ADSL modem or a Cable Modem with an Ethernet connection can also connect directly to the Hub.


Fixed wiring installed in home (Less than 90 Metres)
Wall plates & sockets located in various rooms in the home
8055HUB10
5 Port Ethernet Hub
Patch Lead from wall socket to computer network card
Patch Leads from Ethernet HUB to the distribution sockets of the required locations
Computer fitted with network interface card (NIC)
Printer with built in network interface card

8055HUB10 in StarServe Pro enclosure

Video Distribution

There are two types of video signal transmission referred to in the StarServe system, Baseband and Broadband. Baseband signals are derived from the outputs of DVD Players and VCRs. These signals are modulated onto a Broadband Signal and distributed via StarServe using Modulators. Broadband signals are the signals received from antennas and Modulators. These signals are distributed by the StarServe VDUs.

Baseband Video

Baseband Video is the transmission of a single video signal on one or more cables. The signal consumes the entire bandwidth of the cable and does not allow any additional signals. Typically, this type of video transmission is used over short distances on coaxial or shielded cable. The number of cables required for this type of video transmission depends on the video format.

Composite Video

Composite Video is the only Baseband video that the StarServe Modulators accept.

Composite Video uses a single cable with an RCA connection, usually colour coded yellow. The name Composite refers to the fact that all the components that make the video signal are combined into a single 'composite' signal.

Broadband Video

Broadband Video refers to multiple video signals transmitted via a single medium, such as television (terrestrial broadcast), satellite or cable. Video transmitted over the air (television) is basically the same as that transmitted over cable or via satellite. The primary difference between any of the mediums is the signal level.

To be able to transmit numerous video signals across a single medium, each video signal must only use a portion of the available bandwidth.

Bandwidth

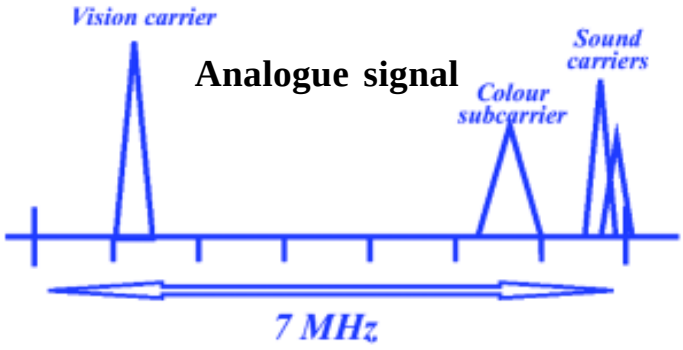
Bandwidth refers to the amount of information a given device or cable can reliably transmit. Bandwidth is indicated by a frequency range. When only a single figure is stated, the assumed lowest value is zero. The higher the value or broader the range, the greater the bandwidth.

A twisted pair system rated at Category 5 or greater has a potential bandwidth of 100MHz. RG-6 quad shield cable can have up to, 29GHz (Gigahertz) bandwidth.

It is important to note that correct installation of cabling and equipment is critical to maintain the maximum bandwidth.

Modulation

For audio and video signals to be transmitted using only a portion of the available bandwidth, they are modulated onto carrier signals within a fixed bandwidth. In Australia, the standard bandwidth is 7MHz, this is known as a channel.



If TVs or VCRs are tuned to a particular channel, it is not tuned into a single frequency, but a 7MHz band from which the audio and video information is retrieved.

For analogue transmission in Australia the vision carrier is 1.25MHz above the lower frequency for a given channel's bandwidth, with the primary audio approximately 5.5MHz above that. The secondary audio is approximately 242KHz above the primary audio.

Australian Channel Allocation

PAL AUS			
Channel No.	Freq. (MHz)	Channel No.	Freq (MHz)
28	527.25	48	667.25
29	534.25	49	674.25
30	541.25	50	681.25
31	548.25	51	688.25
32	555.25	52	695.25
33	562.25	53	702.25
34	569.25	54	709.25
35	576.25	55	716.25
36	583.25	56	723.25
37	590.25	57	730.25
38	597.25	58	737.25
39	604.25	59	744.25
40	611.25	60	751.25
41	618.25	61	758.25
42	625.25	62	765.25
43	632.25	63	772.25
44	639.25	64	779.25
45	646.25	65	786.25
46	653.25	66	793.25
47	660.25	67	800.25

StarServe Video Distribution

The StarServe Video Distribution Units or 'VDUs' distribute broadband video signals to multiple locations within the home and are designed to simplify MATV design. The 8053/8VHPIR VDU supplied with the StarServe 'Video' and 'Pro' allows for distribution of locally generated video signals in addition to free to air TV.

StarServe is essentially the distribution end of a MATV system. Therefore, there is a requirement for a basic understanding of MATV systems in order to implement StarServe correctly.

The major consideration is the 'Head-End' of the system. This comprises of a combination of antennas, baluns, masthead amplifiers, filters and couplers. The StarServe VDU's distribute the signal provided by the 'Head-End' of the system. If this signal is too weak, noisy or arrived from multiple paths ('ghosting'), the signal at each distribution point will be the same.

The Basics of MATV

MATV stands for Master Antenna Television. MATV systems allow multiple receivers (TV & FM) to receive signals from a single (Master) antenna, as opposed to individual antennas for each receiver.

MATV systems are separated into two portions, the 'Head End' and the 'Distribution System'. When these two portions are planned and engineered using suitable MATV equipment and the appropriate installation techniques, signals will be distributed without loss of signal quality.

Any signal passing through system components, including the cable, will be attenuated (i.e., have its level diminished). The level of this attenuation is important, as it will be a factor in signal quality.

Signal quality within the system is related to signal level, system noise and headroom. The system needs to maintain a low noise level and a high signal level. However, the signal must not be too high, as this can overdrive the equipment.

In order to simplify MATV design, the relationship between noise and signal levels is measured (in Decibels).

Decibels

The signal level received on a television antenna is measured in microvolts. Calculations in microvolts are difficult, therefore MATV calculations are carried out in decibels.

Decibels are added and subtracted, as opposed to being multiplied and divided. The decibel is 1/10 of a bel and is derived from a formula originally used by telephone engineers.

The decibel indicates how many times greater or smaller a quantity is from a pre-established reference level. The relationship between dB levels is logarithmic, not linear. Therefore 40 dB is not twice as much as 20 dB. for example.

- 10 dB = 3.2 x reference level
- 20 dB = 10 x reference level
- 30 db = 32 x reference level
- 40 dB = 100 x reference level
- 50 dB = 316 x reference level

In the MATV industry, the zero reference level is 1,000 microvolts measured across 75 ohms of impedance. The reference level determines that a minimum signal of 1,000 microvolts is required to produce an acceptable picture.

The dB figure is represented as dBmV (a reference to 1 millivolt), or dBµV (a reference to 1 microvolt).

MATV amplifier gains, cable losses, insertion losses and isolation values are all expressed in dB. To determine an amplifier output and any system losses, decibels are added and subtracted.

The following dB conversion chart highlights minimum to maximum signal strengths for free to air television signals. The minimum signal for a good quality, noise free picture is typically stated as 0dBmV although most televisions will work with signals as small as -6dBmV. Working to the 0dBmV level will provide a tolerance to slight signal variations. The signal level fed into a television should be kept below 20dBmV so the tuner is not overdriven.

	-6 dBmV Absolute minimum
	-5 to –1 dBmV Less desirable than 0dBmV
	0dBmV The reference level

	1 to 6 dBmV Acceptable signal range
	7 to 19 dBmV Optimal range of signal
	20 dBmV Maximum signal allowable

dB Conversion Chart

Voltage Microvolts	dBmV	dBìV	Voltage Microvolts	dBmV	dBìV	Voltage Microvolts	dBmV	dBµV
10.00	-40	20	1.0	0	60	112.2	41	101
11.22	-39	21	1.12	1	61	125.9	42	102
12.59	-38	22	1.26	2	62	141.3	43	103
14.13	-37	23	1.41	3	63	158.5	44	104
15.85	-36	24	1.59	4	64	177.9	45	105
17.78	-35	25	1.78	5	65	199.5	46	106
19.95	-34	26	2.00	6	66	223.9	47	107
22.39	-33	27	2.24	7	67	251.2	48	108
25.12	-32	28	2.51	8	68	281.8	49	109
28.18	-31	29	2.82	9	69	316.2	50	110
31.62	-30	30	3.16	10	70	354.8	51	111
35.48	-29	31	3.55	11	71	398.1	52	112
39.81	-28	32	3.98	12	72	446.7	53	113
44.67	-27	33	4.47	13	73	501.2	54	114
50.12	-26	34	5.01	14	74	562.3	55	115
56.23	-25	35	5.62	15	75	631.0	56	116
63.10	-24	36	6.31	16	76	707.9	57	117
70.79	-23	37	7.08	17	77	794.3	58	118
79.43	-22	38	7.94	18	78	891.3	59	119
89.13	-21	39	8.91	19	79	**Volts**		
100.00	-20	40	10.00	20	80	1.00	60	120
112.2	-19	41	11.22	21	81	1.12	61	121
125.9	-18	42	12.59	22	82	1.26	62	122
141.3	-17	43	14.13	23	83	1.41	63	123
158.5	-16	44	15.85	24	84	1.59	64	124
177.8	-15	45	17.78	25	85	1.78	65	125
199.5	-14	46	19.95	26	86	2.00	66	126
223.9	-13	47	22.39	27	87	2.24	67	127
251.2	-12	48	25.12	28	88	2.51	68	128
281.8	-11	49	28.18	29	89	2.82	69	129
316.2	-10	50	31.62	30	90	3.16	70	130
354.8	-9	51	35.48	31	91	3.55	71	131
398.1	-8	52	39.81	32	92	3.98	72	132
446.7	-7	53	44.67	33	93	4.47	73	133
501.2	-6	54	50.12	34	94	5.01	74	134
562.3	-5	55	56.23	35	95	5.62	75	135
631.0	-4	56	63.10	36	96	6.31	76	136
707.9	-3	57	70.79	37	97	7.08	77	137
794.3	-2	58	79.43	38	98	7.94	78	138
891.3	-1	59	89.13	39	99	8.91	79	139
1000.00	0	60	100	40	100	10	80	140

The MATV Head-End

The Head End of a MATV system usually consists of an antenna which receives broadcast signals, processing equipment to filter the signals and a distribution amplifier to amplify the signals to compensate for distribution losses. Antennas, amplifiers, taps, filters and attenuates are used in this portion of the system.

The MATV Antenna

The quality of TV reception can be no better than the quality of the signal from the antenna. It is therefore vital to select the correct antenna for the intended location.

Antenna manufacturers produce geographic maps detailing preferred antenna types based on the geographic location. In addition, professional antenna installers carry test equipment to optimise antenna placement and orientation.

The quality and strength of any signal received is determined by the following:-

- Proximity to the transmission tower.
- Power of the transmitter.
- Quality of the transmission.
- Line of sight to the transmission tower.
- Weather conditions.
- Interference from power lines.
- Directional characteristics and orientation of the antenna.
- Level of gain of the antenna.

Antenna Selection

The antenna installation should provide at least 0 dB (1000 µV) of picture signal per channel at the amplifier input.

In strong signal areas this will be relatively easy to obtain. In weak signal areas a larger antenna with a high gain will usually be necessary. It may also be necessary to “stack” two or more antennas. Stacking two antennas will provide an additional 3 dB of gain above the gain of a single antenna. Although a pre-amplifier may be used, stacking before pre-amplification is preferable, as it delivers a cleaner signal to the system.

Antenna directivity is important. Directivity is a measure of how well an antenna will reject signals from any direction other than the front. The front-to-back ratio is one way of measuring an antenna’s directivity. This is the ratio of the amount of signal received by the front of the antenna to the amount of signal received by the rear. A highly directional antenna will generally have a high front-to-back ratio.

Signal Survey

Determining signal levels is one of the most important steps in Head-End design and a signal survey before installing the system will avoid many potential problems.

An antenna, several sections of mast, a field strength meter and a portable colour TV is the equipment required for a signal survey. The field strength meter measures the amount of signal received on each channel. Carefully selected antennas can also do much to overcome certain types of interference. The portable TV allows the quality of the signal received on each channel to be determined.

Masthead Amplifiers

In weak signal areas, it is often necessary to amplify the signal before the distribution amplifier. This will ensure a signal of sufficient strength and acceptable quality. This is achieved using a Masterhead Amplifier.

It is important to choose a Masterhead Amplifier with a low noise figure. The noise figure of the Masterhead Amplifier establishes the noise figure of the entire system, therefore the amplifier should always increase the signal more than it increases the noise.

The MATV Distribution System

A well-designed distribution system is necessary to guarantee an adequate signal at every receiver connected to the system. The distribution of MATV is the role of the StarServe Video Distribution Unit.

The StarServe VDU simplifies the design and hardware requirements of the distribution end. VDUs are combiner/splitter amplifiers in which a single outlet connects to a single receiver. In this way the system provides a predetermined signal level and maintains the correct impedance to each of the outputs. Complex calculation of losses associated with splitters, drop taps and cable are not required.

Each outlet has a defined amount of gain and there is a recommendation for the maximum cable run. The VDU will, in effect, provide the same signal quality to each outlet, as long as the cable recommendations are adhered to.

If there is a poor signal received from the antenna, this same poor signal will be output at each of the VDU outlets. To guarantee a good signal at each of the VDU outlets, as good quality signal needs to be received at the antenna.

Attenuators

As there are many signals received by an antenna, there may be a wide variation in signs levels. In order to ensure the same picture quality on all channels, the signal levels may require equalisation to prevent the stronger signals from overriding the weaker ones. Equalisation is achieved by using attenuators, which reduce the incoming stronger signals by a specified amount.

Attenuators can be either fixed or variable. They are either designed for one specific attenuation level, or they are switchable so that the signals can be reduced in increments to the required level.

Attenuators reduce all signals that pass through by the same amount. Therefore, frequencies that need reducing need to be separated from the rest of the signals so that only the stronger signals are reduced.

Amplifiers

Amplifiers increase the strength of signals received to a level greater than the losses in the distribution system. The amplifier gain determines the level of increase, which should be high enough to provide an acceptable signal level to all televisions in the system.

Although an amplifiers gain is important, the output capability is just as important. The amplifier's specifications should be checked to ensure that the output level is sufficient to feed the system and that the strength of the input signal plus the gain of the amplifier doesn't exceed the amplifiers rated output capability. Exceeding the output capability will result in overloading, cross modulation distortion, and overall signal deterioration.

System Losses

Cable Loss

A certain amount of signal will be lost as it travels through coaxial cable. This loss depends on the type of cable used and the frequency of the signal being carried.

Losses are greater at higher frequencies, the greatest loss occurring at channel 67 in UHF/VHF systems. The cable loss should always be calculated at the highest frequency received or the highest frequency to be received in the future.

Splitter Loss

When a two-way splitter is inserted in-line, the signal in each leg will be approximately 3.5 dB less than that of the main line. If a 4-way splitter is inserted in-line, the signal in each leg is 6.5 dB less than that in the main line. The signal sent to each branch of the system will be equal to the signal sent into the splitter minus the splitter loss. That is, an input of 30 dB into a 2-way splitter will deliver a signal of 30 dB minus 3.5 dB splitter losses, or 26.5 dB to each branch of the System.

Insertion Loss

All tapoff devices inserted into the distribution system create signal loss. This type of loss is called insertion loss, (sometimes called feed-through loss). On the line, the insertion loss of each tapoff is subtracted from the signal carried by that line. When estimating total system losses, the insertion loss of each unit is added together to find the total insertion loss for that system. For example, if there are 10 tapoffs on the line, and each tapoff has an insertion loss of 0.5 dB, the total insertion loss is 5 dB.

For initial calculation, the tapoff values and the insertion losses are estimated as the output of the amplifier will influence the final selection tapoff values.

Isolation Loss

Each tapoff attenuates the signal by a specified number of dB to prevent one set from interfering with another. For example, if there is a 25dB signal in the line, and a 23dB isolation wall tapoff is inserted in the line, the signal available at the tapoff would be 2dB. The 23dB loss is called Isolation Loss. In computing the total distribution system losses, calculate the isolation loss of the last tapoff only. Since the system design requires a minimum of 0dB (1000 µV) to each set, the lowest isolation value should be used. For most MATV tapoffs this value is 12dB.

Interference and Trouble Shooting

Cross Modulation Interference

Cross modulation interference occurs in Broadband preamplifiers and distribution amplifiers when one or more signals (TV Channels) exceed the amplifiers rated output capability. This causes two or more signals (TV channels) to beat together resulting in the picture information of one channel appearing superimposed upon another. This interference usually manifests itself as a windshield wiper effect or as a negative image.

The windshield wiper effect is seen as the vertical or horizontal framing bars of the interfering channel appearing on the channel being viewed. The negative image appears as a superimposed image in the background of the picture on the channel being viewed.

Highly directional antennas and the use of filters and taps to attenuate and control the offending signals can usually eliminate this type of interference.

It is always the strongest signal received that causes the interference and it does not normally show up on the interfering channel. The interfering signal may also be an FM signal or combination of FM and TV signals.

Adjacent Channel Interference

Adjacent channel interference is caused by a strong signal from one channel overriding a weaker signal on an adjacent channel, producing a "herringbone" effect. An adjacent channel is one, which is next to another channel. For example, Channels 1 and 2, 7 and 8, 10 and 11 are adjacent channels. Channels 2 and 3 are not adjacent because there is a 15 MHz band between them. In addition, channels 5 and 6 are not adjacent because there is channel 5A between them.

This interference can be eliminated by using a higher gain antenna to increase the weaker signals and by using attenuators to reduce the stronger signals.

Co-Channel Interference

Co-channel interference is the result of two stations in different locations operating on the same channel. It appears on a TV as two different pictures, as though one were placed on top of the other. The effect can be minimised by using a highly directional antenna, or, if necessary, by stacking antennas.

Power Line Interference

Power line interference is caused by radiation from a high voltage power line close to the antenna. To minimise this interference, the antenna should be located as far away from the power line as possible. A balun should be used as close as possible to the antenna terminals to prevent direct pickup of radiation.

Worn or cracked insulators on power lines can also cause this interference. If the interference shows up intermittently (especially during wet weather), it may be due to cracked insulators on the power lines.

Ghosting

There are three common causes of ghosting:-

- Pickup of reflected signals by the antenna.
- Direct pickup of a signal by the TV or TV lead.
- Poor installation techniques.

Not all signals reach an antenna directly. They can be reflected by buildings, mountains, or bodies of water. These reflected signals arrive at the antenna microseconds after the direct signal. This causes a second, fainter image to appear on the TV screen, just to the right of the main image. This is called a trailing ghost.

A trailing ghost can usually be eliminated by using a highly directional antenna or by stacking antennas. Changing the orientation of the antenna slightly may also eliminate the reception of the reflected signal.

A second image appearing to the left of the main image is called a leading ghost. This is the result of the direct pickup of signal by the TV lead (when using 300-Ohm twin lead), by the TV tuner itself or by the down lead from the antenna.

A leading ghost sometimes occurs in strong signal areas when signal is picked up directly and displayed microseconds before the image picked up by the antenna. Since 300-Ohm twin lead is unshielded and can act like an antenna, it should be removed and replaced with 75-Ohm coaxial cable. A balun should be placed as close as possible to the antenna terminals and the coaxial cable connected to the TV set with a matching transformer. Overpowering the unwanted signal can also eliminate this type of ghosting.

Poor installation techniques can cause ghosting. If the distribution line installations are improperly terminated, the signal can bounce up and down the line, causing multiple images. Proper use of terminators can eliminate this problem at the time of installation.

Poor crimping of “F” fittings can cause an impedance mismatch, and can result in reflected signals in the line. Using a good crimping tool and making sure that all fittings and splices are correctly executed will help ensure trouble free operation of a system.

Cable

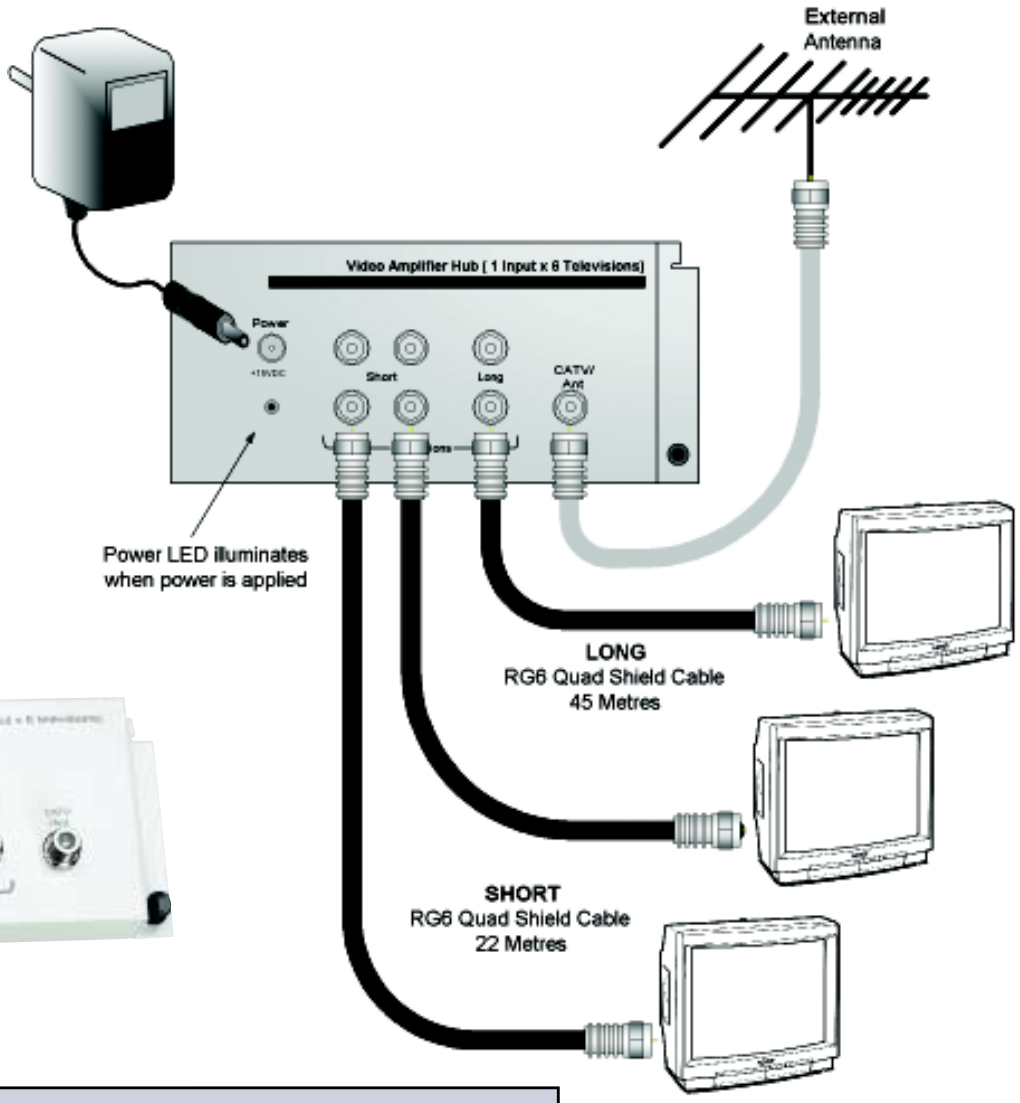
StarServe video cabling should be cabled with RG-6, quad shield, 75-Ohm coaxial cable. Coaxial cable is a concentric transmission line. It consists of a central conductor, a dielectric medium (such as polyethylene) which fixes the spacing between the central conductor and an outer shield (such as copper braid or aluminum foil) and a weatherproof outer jacket (usually vinyl).

All StarServe coaxial cable connections use standard F-Type connectors for faster, easier installation.

Losses in coaxial cable are specified as attenuation per metre of cable.

StarServe™ Lite

The StarServe Lite VDU provides six outlets for video distribution. Four outlets are designated as short and two as long. The distance recommendation for both short and long is based on the level of gain that the VDU provides. Cable lengths in excess of the recommendations will work, as long as the incoming signal level (i.e. the antenna signal) is suitably high.

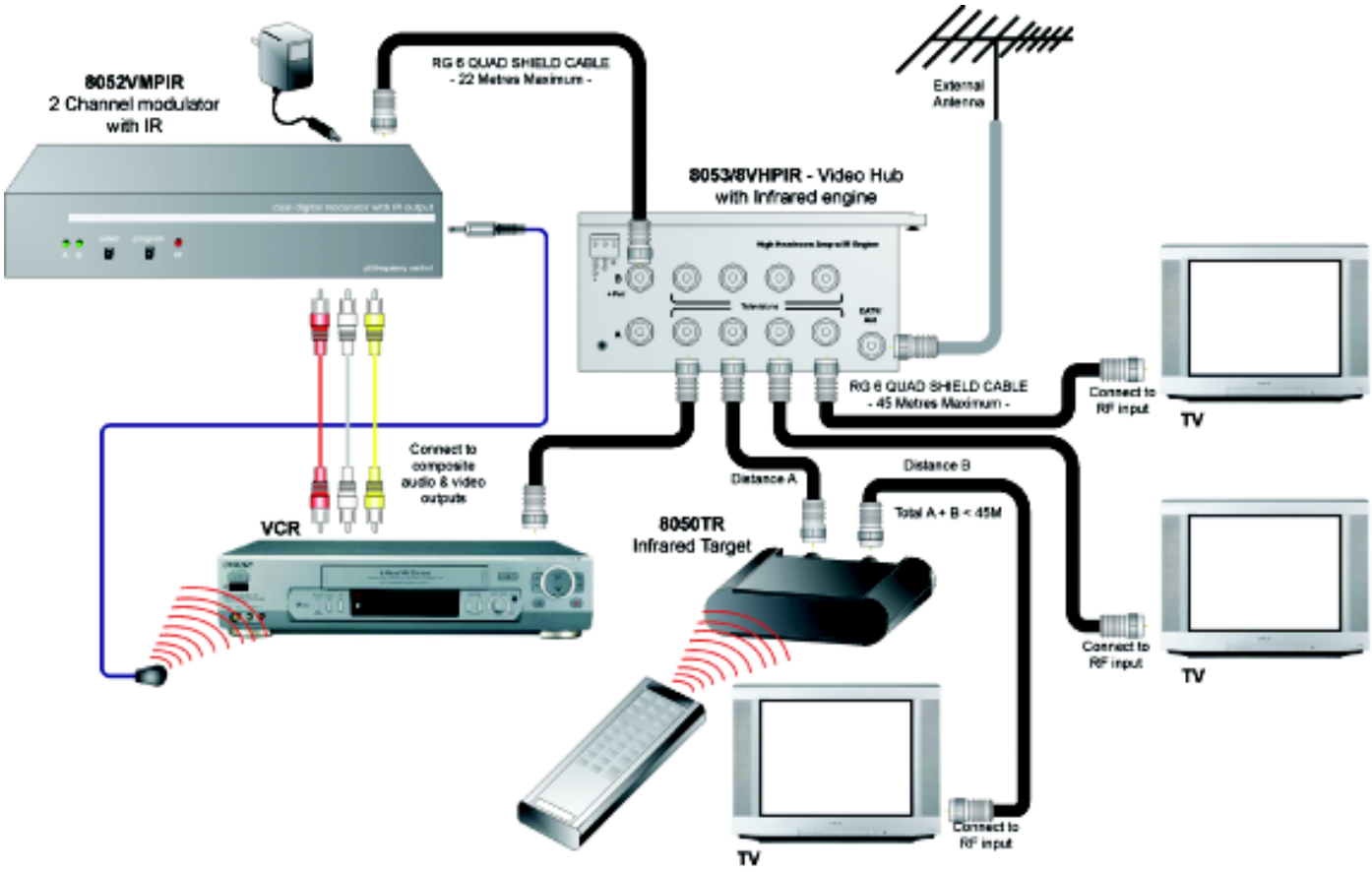


Catalogue No.	8051/6VHP		
RF Input	Max CATV/Antenna Input (64 channels)	20dBmV	
Connector Type		1 x F-Type	
RF Output	Output Type	LONG	SHORT
Number of Runs	2	4	
	Output Run Distance	45 metres	22 metres
Connector Type	2 x F-Type	4 x F-Type	
Output Gain	CATV/Ant input to TV output	4dB	1dB
	TV output to CATV/Ant input	-8dB	-12dB
	(5-42 MHz reverse channel)		
Bandwidth	Forward	54-860MHz	
	Reverse	5-42MHz	
Power Supply	Model Number	8050P12/500	
(Not supplied with	Output Current	500mA (300mA minimum)	
E-Series variant)	Output Voltage	12VDC REGULATED	
	Input Power	240VAC / 50Hz	
Mechanical Details	Dimensions	175 x 88 x 23.3mm (LxWxD)	
	Shipping Weight	1kg	
	Operating Temperature	0 – 50°C	
	Operating Humidity	10 – 95% RH	
	Specifications typical @ 25ºC ± 5ºC		

StarServe™ Video & Pro

The Video Distribution Units (80053/8VHPIR) in StarServe Video and Pro can be coupled together to expand the number of outputs.

Catalogue No.	8053/8VHPIR	
RF Output	Number of Runs	8
	Output Run Distance	45 metres
	Connector Type	8 x F-Type
Output Gain	CATV/Ant input to TV output	3dB
	Modulator input to TV output	-10dB
Bandwidth	Forward	54-860MHz
	Reverse	N/A
Isolation	Modulator input to CATV/Ant	>80dB
RF Input	Max CATV/Antenna Input (64 channels)	20dBmV
	Connector Type	1 x F-Type
Power Supply (Not supplied with E-Series variant)	Model Number	8050P12/500
	Output Current	500mA (300mA minimum)
	Output Voltage	12VDC REGULATED
	Input Power	240VAC / 50Hz
Mechanical Details	Dimensions	160 x 90 x 60mm (LxWxD)
	Shipping Weight (approx)	1.25kg
	Operating Temperature	0 – 50°C
	Operating Humidity	10 – 95% RH
	Specifications typical @ 25ºC ± 5ºC	



Points To Remember

- All video distribution should use RG-6 Quad Shield cable, even the short leads from the wall plate to the TVs.
- The total length for any RG-6 cable run should not exceed the recommended lengths.
- All telephone and data should be cabled with Category 5 cable or greater. This higher grade cable isn't required for telephone service, however having both data and telephone points cabled with Category 5 gives the flexibility to interchange those services.
- No Category 5 cable runs should exceed 90 metres.
- The StarServe enclosure should be located such that cable runs are minimised.

Determine the number of points required (telephone / data / video)

The number of cables and outlets to be installed is a subjective requirement of a StarServe system. It is primarily up to the user to determine the level of infrastructure required for the installation, with recommendations from the installer.

It is essential that the user is made aware of the varying level of infrastructure that can be implemented. A balance needs to be made between cost and flexibility. This can only be done by a user who understands the long term benefits of a structured wiring system.

Various standards make recommendations for minimum cable infrastructure, from these the following guidelines are suggested.

Grade Infrastructure 1 - 2 x Category 5 cables
1 x RG-6 Quad Shield cable

Grade Infrastructure 2 - 2 x Category 5 cables
2 x RG-6 Quad Shield cable

Grade Infrastructure 3 - 3 x Category 5 cables
2 x RG-6 Quad Shield cable

Plan The Installation

Before any cabling is done it is important to plan the entire installation. Firstly, all required services need to be assessed:-

- How many incoming telephone lines.
- How many telephone points / Telephones.
- How many lines to each point.
- How many data points.
- How many television points.
- How many Modulators.

Once these requirements are established, future possibilities can be determined. It is important to make future allowances when determining the number distribution points required. This will greatly determine the flexibility of the system and its future benefits.

Emphasis On Future Requirements

In residential buildings, the purpose in having a structured cabling system is to allow for both current and future service requirements.

Only cabling for the services required today will leave an inflexible system for tomorrow. An installation should be cabled for a range of future possibilities. This provides the flexibility to be able to change the systems within a home, without the need to recable.

Types of Baseband Video

Composite Video

Composite Video is the most familiar format. It uses a single cable with RCA or Phono connections, usually colour coded. Composite refers to the fact that all components that make the video signal are combined into a single 'composite' signal. This means that the 'Luminance' (Black & White detail), 'Hue' (Red, Green & Blue colour balance), 'Saturation' (the richness of the colour) and sync pulses are all combined. The way in which these components are combined is determined by the colour-encoding format (e.g., NTSC, SECAM and PAL). PAL is the encoding video format used in Australia and New Zealand.

Composite video components can interact with one another, distorting the signal. In particular, this can occur when passing through cable, equipment or being recorded and played back.

PAL (Phase Alteration Line) Format

The basic principle of colour video is red, green and blue signals are encoded with a colour sub carrier, then added together to form the composite video signal.

Video signal strength is measured in percentages of the peak signal voltage. As the voltage approaches 100%, the picture gets brighter. As the voltage approaches 0%, the picture approaches black.

To determine colour hue and saturation, video monitors and other decoding equipment compare the colour sub carrier's phase and amplitude with a reference signal.

The amplitude of the sine wave describes how deeply an object is saturated with colour. When the amplitude is increased, the displayed colour becomes deeper.

The phase of the sine wave describes the hue of the object and the dc offset voltage of the sine wave determines how bright an object is. As the offset voltage is decreased, the displayed object becomes darker. This is most noticeable when there is impedance mismatch, i.e. when a single video source is connected to two inputs.

S-Video

To avoid the picture degradation that can occur with composite video, manufacturers provide a different type of video output and input format called S-Video. In S-Video format, the chrominance (all colour information) is kept separate from the luminance (Black & White information) and sync information. This reduces the possibility of interaction.

S-Video signals are transferred via twin coaxial or shielded cables, which are usually fitted with a 4-pin mini DIN plug. Most equipment fitted with S-Video connectors also provides standard composite video connectors.

S-Video can be recorded on videotape (S-VHS), where the two chrominance and luminance remain separated.In principal, the longer these two components remain separated within a system, the less degradation of the signal. It is generally better to use an S-Video connection as opposed to the lower quality composite video.

Component Video

Component Video provides the best picture quality of all analogue formats. In component video, the components of the video signal are separated to a greater extent than S-Video, with less chance of them interfering.

Instead of just separating the luminance/sync (Y) and the chrominance (C) information, the chrominance information is further separated into its own two components, the B-Y (blue minus luminance, also called Cb or Pb) and R-Y (red minus luminance, also called Cr or Pr).

Although not available on all video equipment, this type of connection is becoming more popular as it produces the best picture quality. The connections found are three RCA/Phono sockets, generally marked Y/R-Y/B-Y or Y/Cr/Cb and often-coloured yellow, red and blue respectively.

RGB Video

RGB is similar to component video and consists of the three basic colour components, red, green and blue. Sometimes the sync information is combined with the green video, and sometimes separated. It is used primarily in European equipment, where video connections between equipment are made using multi-way SCART connectors (20 pin oblong connectors). Like Component video, RGB offers the potential of high image quality.

RGB and Component Video are not interchangeable and one type cannot be fed directly into the other. Equipment fitted with a SCART connector does not necessarily mean it is capable of handling RGB video. SCART connectors are used to convey all three types of video, Composite, S-Video and RGB. Always refer to the manufacturers manual to determine the video formats supported.

The Digital Television Signal

The 'digital' signal used for Digital Terrestrial Television Broadcasting (DTTB) is different to the PAL analogue signal. DTTB utilises a form of modulation called COFDM (Coded Orthogonal Frequency Division Multiplex) and is defined by DVB-T standards. The purpose of COFDM is to provide a vehicle for the carriage of digital signals that is highly robust to the effects of echoes or ghosts.

COFDM spreads data between many carriers. Either of two modes of COFDM may be employed, with the '2k mod' having 1705 carriers and the '8k mode' having 6817 carriers. The power is spread evenly over a 6.7MHz portion of the 7MHz channel. This is in contrast to an analogue service, with its concentration of power in the vision carrier at the lower end of the spectrum. The difference in power distribution has important consequences for the measurement of signal level.

How DTTB is transmitted

Digital Terrestrial Television Broadcasting is transmitted using digital modulation in the channels available in Bands III, IV and V, sharing the spectrum with the current analogue transmissions. Unlike analogue transmissions, there is no Band I or Band II transmissions for DTTB.

Existing TV transmitters will generally be used for DTTB transmissions. Although successful reception via existing antennas will normally be experienced, optimum reception of DTTB may require some modifications.

Digital Services

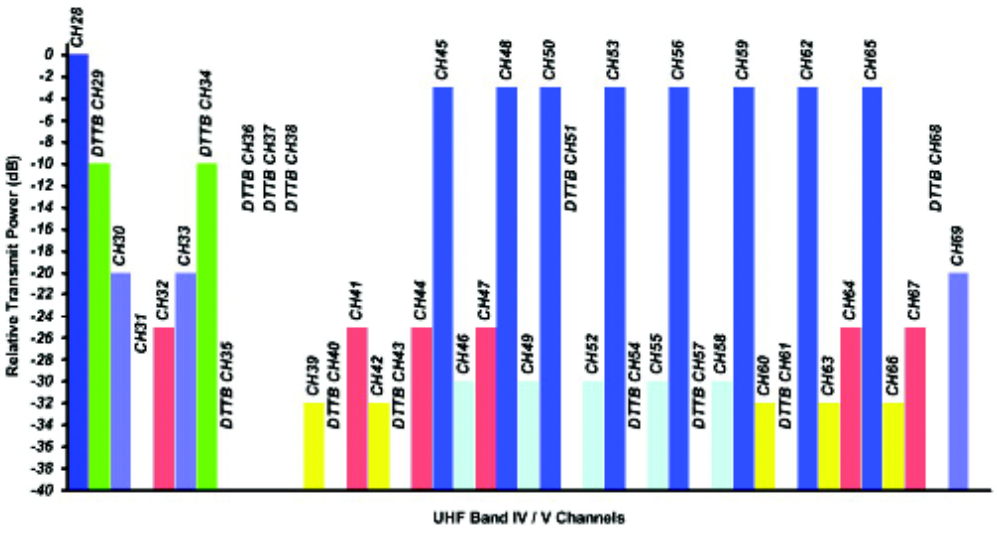
Each Digital Service will occupy a 7 MHz channel and may contain a HDTV programme, a SDTV programme or multiple programmes, all available in 16:9 display format. Associated with the picture will be surround sound up to '5.1' channels, together with text and data information, closed captions for the hearing impaired and the potential for interactive enhancements.

Spectrum Utilisation

For those VHF allocations in state capital cities, a spectrum arrangement has been adopted where the adjacent channels will be used to transmit DTTB at a lower power than the existing VHF analogue PAL transmissions.

The actual ratios between PAL and DTTB will depend upon the detailed planning and interference restrictions in and around the particular city.

Figure 2: Capital City and Regional UHF Spectrum Example



Same Coverage

A planning requirement for all service areas is the concept of 'same coverage', where the introduced DTTB service is received by viewers currently receiving an analogue service.

It is important to ensure the signal level variation is adequate for the long-term robustness of the DTTB reception, rather than installing a 'just adequate' antenna system. This requirement for successful long-term DTTB reception may usually be met by ensuring the receiving antenna provides successful and robust analogue reception.

The greater efficiency of digital modulation results in less power required to provide the 'same coverage'. Depending on the planning requirements of the particular area's digital coverage, the power for digital may be as low as one-tenth of the analogue power.

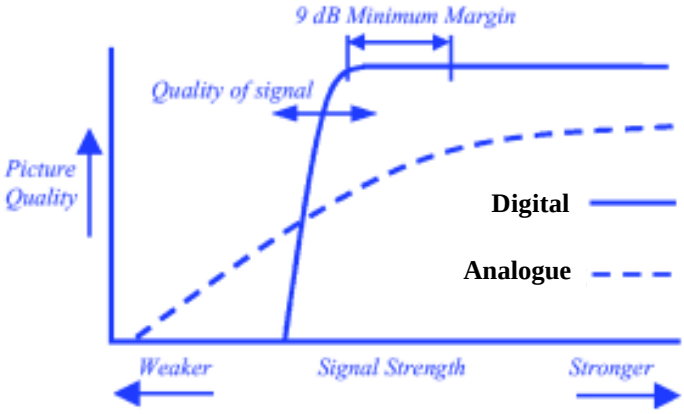
The digital services will normally be transmitted via the same antennas as the current analogue services. Hence the ratios of digital to analogue powers will be similar in all directions.

The received signal level required in a particular location to achieve long-term successful reception of all digital services will depend on the following.

The Digital Cliff Edge

Unlike an analogue TV signal, which can be viewed at weak signal strengths or in corrupted conditions, DTTB TV picture and sound will either be perfect, in the process of breaking up or non-existent.

The penalty for near perfect pictures and sound is that DTTB reception exhibits a very rapid change from being excellent to disappearing. This phenomenon in general is referred to as the 'digital cliff edge' or 'threshold'.



For reliable long-term reception of a digital service, the level and quality of the signal needs to have sufficient margin to stay away from the cliff edge!

Digital TV Signal Levels

The measurement of the signal level delivered to the input of the receiver is the initial easy check on the suitability of the installation. The levels recommended below have allowances to cater for reception of Band III, IV and V in most environments experienced in city and rural locations.

The rule of thumb developed in analogue reception is 1mV or 60dB µV for a successful installation. The potential rule of thumb for digital TV reception is 0.5mV or 54dB µV. This guide for digital signal levels is correct if the analogue service in the presence of the digital service is of fair quality, i.e., if the analogue service has moderate ghosting and little interference.

Other important information on Digital TV Signal Levels:-

a) When the antenna system has an amplifier, the maximum limit is still applicable to the receiver input, but the minimum and preferred levels are now applicable to the amplifier's input.

In amplified systems, the Carrier to Noise ratio should be measured and should be a minimum of 29dB (preferably 43dB).

b) The lowest level that can be received and still provide picture and sound (the threshold or cliff edge), is approximately 31dBµV, when there is little multipath and no interference.

c) The nominal modulation parameters are 64QAM with a 2/3 FEC. Other alternate modulations, for example of 64QAM with a 3/4 FEC, will have a different minimum reception level of approximately 33dBµV.

The cliff edge characteristic invites the definition of a margin the signal has to achieve before the cliff edge is reached. By the insertion of an attenuator in the input of the receiver or amplifier, the level margin may be found.

d) The recommended minimum level margin is 9dB for the first level of caution. This will cater for short and long-term variations. Obtaining the preferred level, in ideal reception conditions, would produce a preferred level margin of greater than 20dB. With more complex multi-path reception conditions and modulation using 3/4 FEC, this level margin may be reduced to perhaps 16dB.

All the channels expected to be received must be received reliably. Hence the level margin must be checked on all channels. Further quality checking must also be assessed on all channels.

Impulse Noise Interference

Impulse noise from house appliances, vehicle ignitions or overhead power lines may interfere with the reception of the digital services, causing intermittent picture blocking or freezing. The disturbance to sound may be of greater annoyance. Both level and quality margins may be consumed by the interference caused by impulse noise. If the interference is not being received via the antenna, an increased signal level (either by use of an amplifier or a higher gain antenna) may reduce the problem.

Further improvement to reception quality may be provided by:-

a) Correct matching of the antenna cable to the antenna balun.
b) Use of double or quad screened cables between the antenna and outlet plate.
c) Use of double or quad screened fly-lead from the wall outlet to the receiver.

Interference From Other Services

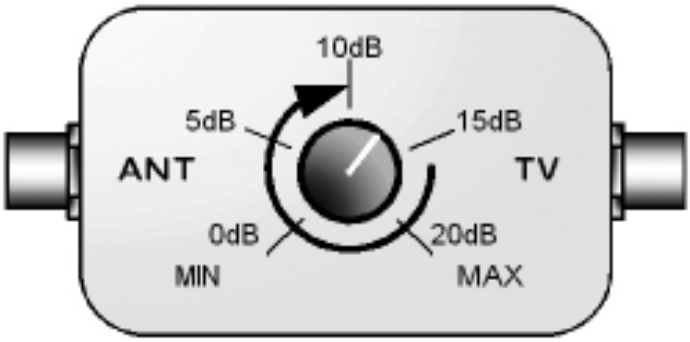
Interference from adjacent channels or co-channel broadcast services may result in reduced margins. As experienced in analogue reception, a reduction in the level of the interference is the first approach to a solution.

Depending on the direction from which the interference is originating, antenna repositioning or antenna type may provide a solution. The performance of the receiver to these types of interference varies between models and brands.

How To Measure Signal Strength

Professional installers have access to field strength meters. However, for a rough guide on signal strength, a variable attenuator can be used. These are available from most electronic stores.

Attenuators are approximately linear devices and, by noting the position of the dial, the attenuation can be estimated within a few dB. Marking the attenuator will assist in approximation. For example, if the attenuator is variable from 0dB to 20 dB then midway will be approximately 10dB.

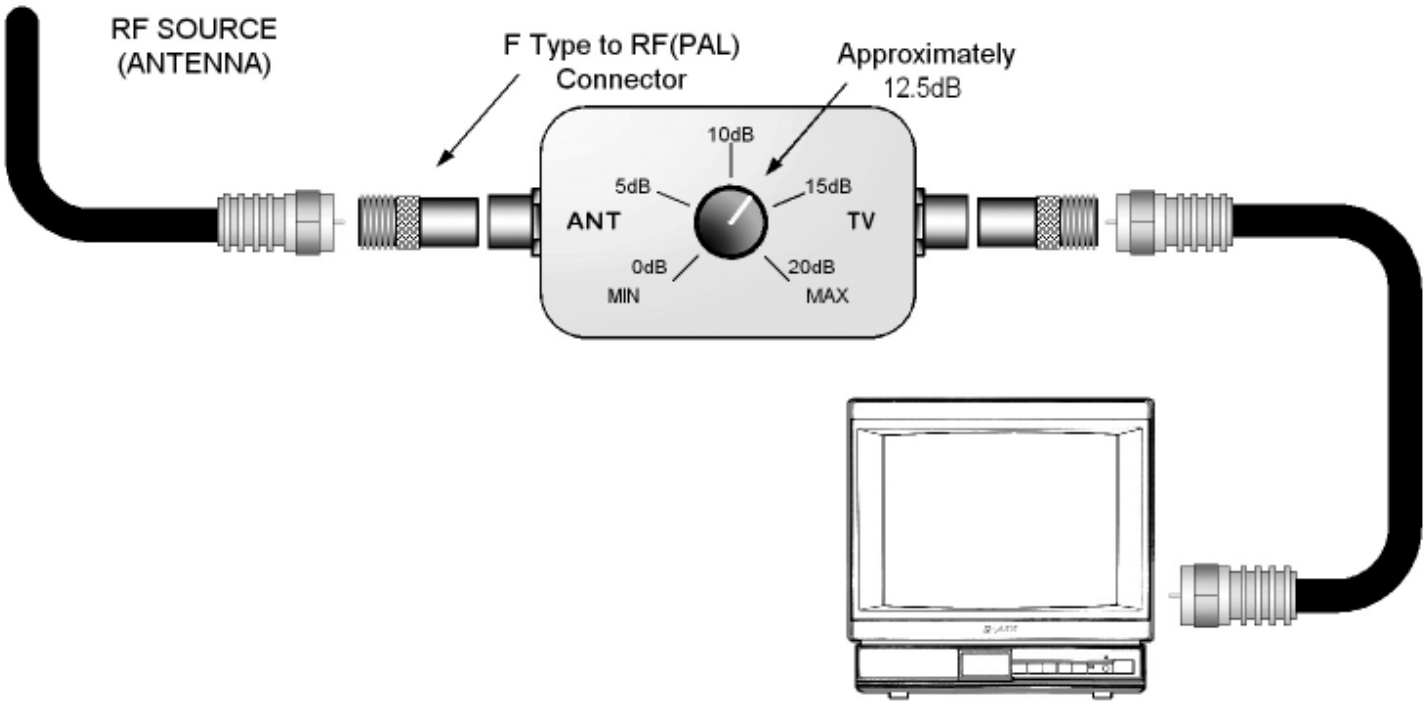


Note:-

A. The attenuators do not come with 0-20dB markings.
B. The numbers refer to the amount that the signal is reduced.
C. Do not leave these units in a system permanently.

Approximating Signal Level

The tuner in modern televisions have a 'knee' in performance at about -10dBmV input signal strength. Below this 'knee', the noise begins to increase rapidly. (Note: Noise is identifiable as snow. If there is a pattern to when it is seen, it is not noise).



1. Connect the variable attenuator to the TV set and tune to a station.
2. Increase attenuation until the 'knee' is found (the point where noise begins to rapidly increase). Noise is easiest to see on a black background, wait until the screen turns dark to perform this test.
3. Note the amount of attenuation add this number to -10dBmV.
4. This is the signal strength of this station.
5. Typical accuracy of this method is about +/- 3dB.

This technique can also be used to identify stations that are far stronger than the other stations (these can cause problems when using an RF amplifier).

Notes

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